

Current Report

The Narragansett Bay Project

GOVERNANCE OF NON-POINT SOURCE INPUTS TO NARRAGANSETT BAY:

A PLAN FOR COORDINATED ACTION

prepared for

The Narragansett Bay Project
R.I. DEM/ U.S. EPA

by

Jennie C. Myers

Consultant to John Ehrenfeld & Associates
Cambridge, Massachusetts

Mark Murray-Brown, Research Assistant

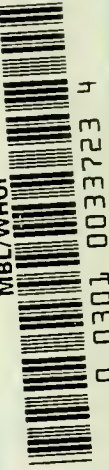
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FOREWORD

The United States Congress created the National Estuary Program in 1984, citing its concern for the "health and ecological integrity" of the nation's estuaries and estuarine resources. Narragansett Bay was selected for inclusion in the National Estuary Program in 1984 and designated an "estuary of national significance" in 1988. The Narragansett Bay Project (NBP) was established in 1985. Under the joint sponsorship of the U.S. Environmental Protection Agency and the Rhode Island Department of Environmental Management, the NBP's mandate is to direct a five-year program of research and planning focussed on managing Narragansett Bay and its resources for future generations. The NBP will develop a comprehensive management plan by December, 1990, which will recommend actions to improve and protect the Bay and its natural resources.

The NBP has established the following seven priority issues for Narragansett Bay:

- * management of fisheries
- * nutrients and potential for eutrophication
- * impacts of toxic contaminants
- * health and abundance of living resources
- * health risk to consumers of contaminated seafood
- * land-based impacts on water quality
- * recreational uses

The NBP is taking an ecosystem approach to address these problems and has funded research that will help to improve our understanding of various aspects of these priority problems. The Project is also working to expand and coordinate existing programs among state agencies, governmental institutions, and academic researchers in order to apply research findings to the practical needs of managing the Bay and improving the environmental quality of its watershed.

This report represents the technical results of an investigation performed for the Narragansett Bay Project. The information in this document has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement #CX812680 to the Rhode Island Department of Environmental Management. It has been subject to the Agency's and the Narragansett Bay Project's peer and administrative review and has been accepted for publication by the Management Committee of the Narragansett Bay Project. The results and conclusions contained herein are those of the author(s), and do not necessarily represent the views or recommendations of the NBP. Final recommendations for management actions will be based upon the results of this and other investigations.

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Mark Murray-Brown provided valuable research assistance during the early months of the study.

List of Abbreviations

ACP	U.S. Dept. of Agriculture, Agricultural Conservation Program
ASCS	U.S. Dept. of Agriculture, Agricultural Stabilization and Conservation Service
AWQMP	Areawide Water Quality Management Plan
BMPs	best management practices
Corps	Army Corps of Engineers
CRC	Coastal Resources Center, U.R.I.
CRMC	Coastal Resources Management Council
CRMC	Coastal Resource Management Program
CSO	combined sewer overflow
CWA	Clean Water Act
DEM	Department of Environmental Management
DOH	Department of Health
DOP	Division of Planning, Department of Administration
DOT	Department of Transportation
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERICD	Eastern Rhode Island Conservation District
GIS	Geographic Information System
GLRI	General Laws of Rhode Island
gpd	gallons per day
ISDS	individual sewage disposal system(s)
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSD	marine sanitation device

NEIWPCC	New England Interstate Water Pollution Control Commission
NOAA	National Oceanic and Atmospheric Administration
NURP	Nationwide Urban Runoff Program
OEC	Office of Environmental Coordination, DEM
PAH	polynuclear aromatic hydrocarbons
POTW	Publicly Owned Treatment Works
RC&D	U.S.Dept. of Agriculture, Resource Conservation and Development Program
RCWP	U.S. Dept. of Agriculture/U.S. EPA Rural Clean Water Program
RI	Rhode Island
RIGIS	Rhode Island Geographic Information System
RIPDES	Rhode Island Pollution Discharge Elimination System
SAMP	Special Area Management Plan(s)
SCS	U.S. Dept. of Agriculture, Soil Conservation Service
URI	University of Rhode Island
WWMD	Wastewater Management District

EXECUTIVE SUMMARY

Overview

This report presents the results of a comprehensive research effort analyzing non-point source governance needs in the Narragansett Bay Basin, Rhode Island. It outlines a management approach addressing technical problems, institutional needs, and necessary responses.

The current and potential vulnerability of Bay resources to non-point source contamination is such that a fundamentally conservative prevention-oriented strategy consistent with the history of national hazardous waste regulation is warranted. Management of hazards in the environment is analogous to protection of the Bay, in that decisions must be made in the absence of optimal levels of scientific information. For seafood consumers, fishermen, recreational users, and wildlife, consequences of human actions cannot be allowed to reach proportions beyond our control.

Development of an effective non-point source control program for the Narragansett Bay must involve significant commitments at several levels on the part of the State of Rhode Island. Executive and legislative leadership is needed to confirm objectives and to provide funding mechanisms complementing available federal financial assistance. Rhode Island's overwhelming support for open space acquisition, for local comprehensive planning, and for a constitutional amendment supportive of strong resource protection all constitute a strong political mandate for correction of the Bay's challenging problems.

KEY FINDINGS AND CONCLUSIONS

Resource Vulnerability

State water quality data indicate that non-point source pollutants, particularly sediment, oxygen-depleting substances, nutrients, and pathogens, can be considered responsible for habitat loss, use restrictions, and closure of former shellfishing areas in Narragansett Bay, particularly in poorly-flushed embayments. Sources of particular concern addressed in this study include, in general order of importance, stormwater runoff, eroded sediment, nutrients derived from waste disposal facilities (ISDS), agricultural sources, marine waste discharge, and road salt.

Current state projections for significant population growth suggest that degradation due to stormwater runoff, construction-related erosion, ISDS loadings, marine discharge, and lawn care related contaminants is likely to increase steadily within the 1990's.

As non-point source pollutant loadings have increased, losses of wetland areas capable of mitigating resource impacts have also escalated, particularly in inland areas and along tributary streams. Dramatic development pressure has led to seriously deficient protection of buffering capacity in estuarine and inland areas, and to the sacrifice of intrinsically important resources.

The long-recognized need for continuing assessment of the status of resources in the Bay and its tributaries has been insufficiently addressed. Until recently, research has been targeted toward localized contamination events, requiring decision-makers to rely upon uneven, inconsistent data in setting action priorities and allocating scarce resources. A permanent, consistent monitoring program for water quality, fish and shellfish resources, nearshore habitat and wetland conditions is urgently needed. As previously articulated, however, available data is sufficient to support priority setting, strong preventive action, and reduction of source inputs.

Institutional Issues

While Rhode Island's existing institutional framework could potentially be adapted to achieve improved control of non-point source impacts in the Bay, cross-cutting problems require that the state's entire approach to environmental management be addressed. The cross-media character of non-point source impacts, and the pervasive nature of degradation across jurisdictional boundaries creates an imperative for watershed-based management. Rhode Islanders thus face an opportunity to refine and clarify management objectives and strategies while providing for complementary land use controls.

Management decisions presently tend to be crisis driven, due to an emphasis among all review bodies upon achieving efficient permitting decisions to the exclusion of broader, less politically-charged needs. Expanded resources must be devoted toward coherent program development and coordination, strategic planning, review of program effectiveness, and enforcement.

Local-state coordination must be improved and approaches rationalized. Presently, strong regionalism and a disparity at all levels among points of view, perceptions, expectations and agendas frustrates formation of coherent long-term strategies. Interagency competition and transference of responsibility have damaged the credibility of certain agencies to the point where their ability to exert leadership and to make necessary decisions may be seriously threatened.

Because of the intimate relationship between land use and water quality in the Narragansett Bay, the future viability of critical Bay resources depends heavily upon the enactment and enforcement of local laws and regulations. Local zoning enabling authority must be strengthened to give towns full authority to exercise control over the impacts of land use upon public welfare. Vigorous outreach efforts need to be undertaken to support local initiative, given widespread concern regarding cost and outcome of potential litigation. Expanded in-house legal support is needed in key state agencies to provide objective advice to towns as to legitimate exercise of local authority.

The Resource Management Context: Shared, but Clarified, Responsibilities

Non-point source management is integral to providing for sustainable growth and should form an integral part of the upcoming comprehensive planning process, to be undertaken by communities with state guidance. Towns should view the planning initiative as an opportunity to clarify long-term objectives and to institute sound data management and planning practices which will consistently serve long-term needs. Technical planning capability in many Bay basin communities is woefully inadequate to meet escalating requirements and needs. Permanent full-time professional planning positions should be created and funded at the town level in all basin communities, or should be shared cooperatively if necessary.

At the state level, resources should be devoted toward setting long-term management direction, establishing consistent statewide control standards, rationalizing the fragmented permitting process, and providing state resources and oversight to support effective management of short-term impacts at the local level. In addition, the state must take the responsibility for coordinating point and non-point source management efforts and for directing sludge and septage management policy in a manner consistent with non-point source control needs.

Priority non-point source management problems should be addressed via a flexible program encompassing land use management, source controls, targeted use restrictions, remedial action and acquisition. A grant-in-aid program analogous to EPA's existing Clean Lakes Program

should be established to encourage towns to work cooperatively in addressing watershed concerns.

Critical areas should be statutorily defined and should form the basis for near-term resource management efforts generally and for imposition of consistent state performance and construction standards for non-point source management. The technical requirements, recommendations, and language of the Stormwater Management and Erosion Control Committee findings should be incorporated into all relevant state and local policy statements and regulations.

Existing legislative authorities of CRMC and DEM's Division of Groundwater and Freshwater Wetlands and Division of Water Resources should be liberally interpreted to ensure protection of critical resources from impacts of non-point source contamination. State stormwater management legislation, and a strengthened sediment and erosion control statute are urgently needed. The recommendations of the interagency ISDS Task Force and the 1986 Wetlands Task force should be implemented. Engineering and enforcement capability sufficient to maintain adequate state oversight must be provided.

Development review procedures should be revised to improve consistency, predictability, and accountability via enhanced use of analytical tools and clarified interpretation of policy. Strict interpretation of a water-dependent use criterion by CRMC, rationalization of the water quality certification process, and consistent interagency interpretation of waterbody use designations are needed. Where water quality characterizations cannot be based upon direct source/quality linkages, verifiable technological controls should be put in place.

Clear standards and policy guidelines should be established which clarify procedures for granting variances, variations, and special exceptions. The Administrative Procedures Act requires revision to establish legitimate entry criteria. Provisions for issuing stop-work orders and requiring habitat restoration requirements should be clarified, as should criteria regarding issuance of administrative penalties to private individuals and public agencies.

Until they are rectified, incongruities among institutional practice at federal, state and local levels will continue to inhibit progress toward effective resource protection and management. The effects of inconsistencies are exacerbated by poor communication among and within state and local agencies, insufficiently trained and/or informed local inspection and enforcement authorities, and a willful disregard for environmental concerns among many contractors to public agencies. Permanent interagency consultative groups should be formed to facilitate cooperation among agencies concerned with related resource problems. Contracting procedures require substantive review and revision.

Financing

Progress on management of non-point source impacts on Narragansett Bay will require that significantly increased funding be devoted to state and local level staffing, enhanced technical assistance to local governments, inspection and enforcement, public education, and assessment and monitoring capability. Enhanced resource viability should return the public's investment.

Staffing

Staffs of Conservation Districts, the Division of Planning, CRMC, and DEM should be increased to provide sufficient qualified personnel to meet agency responsibilities in technical assistance, management, inspection, and enforcement. State personnel, evaluation, and compensation policies must be adjusted so as to enable the state government to attract and retain qualified professionals in demanding, responsible positions.

TECHNICAL SUMMARY OF FINDINGS AND RECOMMENDATIONS FOR MANAGERS

Introduction

This section presents overall recommendations for actions needed in order to prevent further deterioration of Narragansett Bay due to non-point sources, and to work toward restoration of degraded areas where impacts of non-point inputs have been felt. This strategy is designed to be viewed in the context of a comprehensive water quality protection program addressing Narragansett Bay basin fish and shellfish, wetlands, wildlife habitats, open space, natural shoreline storm protection features, and potable water supplies.

Fundamentally, the plan's objective is to restore and protect biological health and diversity in Narragansett Bay. A primary goal in reaching toward that objective is to prevent any increase in the introduction of non-point source pollutants to the waters, sediments, and shorelines of the Bay, and to reduce, and eventually control the introduction of non-point pollutants to the watersheds of the Bay basin. Although nearly two-thirds of the Bay basin lies within the State of Massachusetts, the plan places primary concentration on governance needs in Rhode Island, as requested by the Project sponsors. The plan's emphasis on prevention recognizes the overwhelming costs involved in cleaning up formerly productive estuarine resources. At the same time, there is a clear acknowledgement that necessary remedial actions must be expediently undertaken.

Although definitive scientific statements cannot yet be made regarding many non-point input magnitudes and effects, scientific knowledge is sufficient to support decisive preventive action, to support defensible priority setting among source control efforts, and to indicate the critical need for continued scientific research and monitoring.

The plan recognizes the magnitude of Narragansett Bay basin non-point problems, and the extraordinary challenge which their solution presents. In view of the diversity of sources involved, the plan requires that responsibility be broadly shared among many institutions in the Narragansett Bay region, and recommends that partnerships among state, local, and regional entities be formed. At the same time, the plan calls for development of interstate programs to control inputs from the entire basin.

While the plan acknowledges the extremely important role played by private resource protection groups in Bay restoration and management, it anticipates that fundamental responsibility for non-point source control should fall to state and local government, and to those whose activities or properties contribute to the pollutant loadings.

The suggested approach emphasizes use of a watershed program basis, calls for inter-agency rationalization of targeting and review methodologies, and urges definition of specific responsibilities in distinct areas. Strong, creative actions must be taken in response to difficult management situations.

Extensive interviews, a thorough review of the applicable literature, and numerous case study results have been utilized in devising the plan. This summary provides a basis from which to evaluate the complete range of alternatives advocated in the body of the plan.

Developing a Non-point Source Management Strategy

The design of a Bay non-point source management program presents the opportunity to review a range of existing protection policies and control strategies. Because this initiative coincides with important review of land use and water policy on the state level, and with redirection of key programs at the federal level, much can be accomplished.

Efforts should be carefully coordinated so as to put in place a non-point source management framework which utilizes a mix of techniques including land use management, source-oriented controls, water quality standards, water area use restrictions, remedial action techniques, and land acquisition. Techniques should be developed, however, giving careful attention to interrelationships among pollutant sources, to the need for joint protection of groundwater and surface water quality, and to potential interactions among controls and management practices.

Designation of critical areas, though problematic, must be considered as necessary in order to make best use of limited resource protection funds. Vulnerability should be considered as a more important factor than either use or quality, since the plan, and existing state policy, emphasize restoration of Bay habitat and resource viability. Critical area vulnerability should be based on physical characteristics and extent of existing degradation. At the same time, efforts should be made to avoid developing a guiding strategy in which selective management and classification creates an institutional bias in favor of areas designated as critical areas, to the exclusion of proper attention to retrofitting and remedial action in degraded areas of the Bay system.

Involved agencies should build on the flexible problem-solving objectives of the special area planning process to place increased emphasis on watershed-based planning and management, and to foster development of regional inter-community cooperative programs. In general, emphasis on pro-active planning and management needs to be increased so that vital resource areas can be protected.

The 205j program's priority setting framework should be used in establishing detailed water quality goals to guide non-point pollution efforts in specific areas, particularly poorly flushed embayments and their tributaries. A targeted planning process needs to be put in place for these selected areas which clearly links defined water quality goals to control programs and requirements via water quality characterization. Specific, monitored discharge reduction programs need to be devised. At the same time, specific standards should govern development siting and design to ensure that water quality concerns form a basis for decision-making regarding construction, operation, and maintenance.

DEM and CRMC should develop a pre-development and post-development water quality monitoring program for use in critical watershed areas and estuarine waters. The agencies should jointly define how water quality measurements will be used in evaluating the adequacy of stormwater, erosion, and sedimentation control measures and facility designs. Similarly, they should define how water quality measures will be used in measuring adequacy of facility performance through time, and in initiating enforcement procedures where maintenance schedules specified in

operation and maintenance plans are not adhered to and non-point source controls are allowed to become insufficiently effective.

As an aspect of the preceding responsibility, a two-part management oriented water quality standard should be established in which each agency responsible for regulating activities with a potential for contaminating waterbodies would set both a preventive action limit and an enforcement standard to complement use of best management practices.

The preventive action limit would be a small fraction of the companion enforcement standard; violation of this limit would trigger an examination of possible responses by the administrative body having jurisdiction over the source. Depending on the actual or potential seriousness of the contamination, the agency could require site-specific remedial action, revise agency rules to address the problem, or take no action. Violation of the enforcement standard would trigger an immediate enforcement action against the violator.

An interim non-degradation category should be devised to designate groundwater recharge areas or water bodies which are not presently used for water supply, but which may be so used in the future or may be hydrologically connected to vulnerable aquifers.

State Level Authorities

Existing Statutory Tools and Established Jurisdiction

Although some important tools are already in place, non-point source control authorities need to be further developed, refined, and updated. The lack of state stormwater management legislation is a major impediment to effective action, and needs to be rectified. Similarly, the existing sediment and erosion control statute requires strengthening to provide improved guidance and to ensure adequate state oversight. Statutory language in both cases should include statements of findings; define implementation steps, priorities, and responsibilities; provide adequate funding authorizations; and specifically reference related state and federal requirements.

Tools presently available need to be strengthened and liberally interpreted. For example, CRMC's broad ecosystem protection mandate allows it to set ecosystem based discharge criteria within a broad geographical area. At the time of its 1983 program revision, CRMC conclusively established authority over the 200-foot contiguous area landward of coastal "shoreline features," and also reaffirmed its authority to regulate the six specific activities or land uses mentioned in the Council's enabling legislation "regardless of their actual location."

Particularly through the authority provided by Special Area Management Plans, CRMC possesses considerable authority to regulate development in view of its potential impact on the coastal environment. CRMC's ecosystem protection authority should be interpreted as broadly as possible in drawing substantive policy connections between land use and impacts on coastal resources.

The Wetlands Section of DEM regulates the alteration of wetlands and limited zones of influence. Activities inducing "alteration" include any filling, excavating, grading, draining, or construction in or near wetlands.

The Wetlands Protection Act's broad resource definition gives the Wetlands Section authority to consider effects of development on interconnected components of wetland systems and on floodplains, and to require installation of facilities to mitigate non-point pollutant impacts. Despite its authority, however, statutorially restricted buffer dimensions, and lack of engineering and enforcement capability limit the Section's capacity to undertake broader initiatives in non-point source control.

Whether implementation of controls is based primarily on networking and expansion of existing state programs or on development of local regulatory and planning initiatives, specific state standards need to be established to ensure consistency, predictability, and accountability. At the same time, a grant-in-aid program should be established to encourage development of targeted state-local initiatives in critical areas.

Estuarine Water Quality Management:

Land Use Controls

Because non-point source loadings are so closely linked to land management, land use must be carefully controlled adjacent to resource areas and throughout the Bay basin where land uses may induce groundwater contamination, hydrologic modification, or discharge of non-point and point pollutants. CRMC should interpret its authority in this area broadly, and should be provided with sufficient resources to work with the Division of Planning from the inception of the upcoming comprehensive planning process to ensure that zoning practice is consistent with sound ecosystem protection and hazard area management principles.

Development review procedures should be revised to give strict preferred consideration to those forms of commercial activity which clearly are water dependent and which are primarily oriented to the coastal region such as designated port areas, boatyards, ferry operations and marinas. Specifically stated selection criteria for water-dependent uses would not only provide improved predictability to applicants, but would also give support to municipalities in developing harbor management plans and establishing marine or waterfront zoning districts.

Source-oriented Controls

To address non-point source control in a consistent manner, all applicable state and local regulations should be revised to, at a minimum, specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee findings. The documents in preparation provide guidance regarding stormwater management and erosion/sedimentation control planning for water quality protection, design and installation of best management practices, and maintenance and repair of facilities. Applicable controls and maintenance and repair provisions should be attached to all permits.

A source classification system should be used to set priorities among major non-point source discharges, so that monitoring and enforcement efforts can be concentrated on

sources (such as highways, equipment maintenance areas, and certain agricultural operations) that contribute the most significant loadings of the most serious contaminants.

Waterbody Use Designations

DEM and CRMC water quality and area use designations contribute to difficulties in maintaining management consistency. Basically, the conflict turns on differences between program mandate and on jurisdictional inconsistency. DEM places program emphasis on impacts of discharges to receiving waters, concentrating on waterbody character, while CRMC's broad resource management mandate encompasses appropriateness of use. CRMC tends to interpret its land use control jurisdiction narrowly, placing heavy emphasis on the need for support from local zoning, but claims primary jurisdiction with regard to determining appropriateness of water area use.

A water quality characterization process should be used to link biological integrity with effects of present use to the maximum extent possible. Waste load allocations and effluent limits should be established to coordinate the simultaneous imposition of point source discharge limits and non-point source controls. Guidelines developed should include specific standards to govern the siting and design of development and so as to consider water quality concerns as a basis for siting, operation, and maintenance. The revision process should be utilized as an opportunity to develop a framework allowing for significantly strengthened consideration of cumulative effects. Where direct causal linkages cannot be established between non-point source discharges and ambient water quality, technological controls or verifiable technology-based effluent limitations should be used to establish a uniform approach to control.

Remedial Action Measures

Although remedial activities will be accorded lower priority than attention to preventive action in rapidly developing areas, the benefits of retrofitting may be dramatic, particularly where highway and drainage facilities are concerned. Retrofitting techniques applied to existing structures, and their impacts in restoration of degraded resource areas should be fully examined. Other states' experience with grant-in-aid programs encouraging retrofitting and use of post-storm restoration opportunities in retrofitting should be carefully evaluated.

Retrofitting should be heavily emphasized in development of harbor and shoreline SAM plans, and through the Coastal Community Assistance grant program.

Acquisition

Certain sensitive areas which contribute to non-point source loadings (such as highly erodible areas or saturated soils having high effluent content) or mitigate non-point source loadings (such as floodplain runoff storage areas) should be considered as having high priority for public acquisition, as these areas may be more easily managed as open space or recreation areas. Similarly, fragile Bay watershed areas which are highly vulnerable to non-point source inputs, and which influence Bay habitat quality, should be given priority attention.

CRMC should work with DEM, the Division of Planning and the towns to coordinate public acquisition programs (including land donations, public purchase of development rights and conservation easements, voluntary deed restrictions) and other such land conservation tools so as to develop a coherent resource protection program which carefully considers non-point source control objectives. Where lands are acquired, best management practices should be installed and maintained as demonstration projects, to illustrate methods and benefits of various control strategies.

Issues Related to Permit Evaluation

Focus

Largely because of political pressure generated by applicants' frustration with the permit process, review bodies tend to focus on achieving efficient permit decision-making, reducing emphasis on broader program development, strategic planning, program coordination, review of cumulative effects, and enforcement. Staff limitations exacerbate the burden of permit review.

Permitting Sequence

Current permit review and evaluation procedures are complicated, and frequently cannot make best use of scientific expertise in an effective, timely way. Building and subdivision permits are obtained from a range of town commissions, approval for on-site sewage disposal systems is granted by DEM's ISDS Section, water quality certifications and freshwater wetlands permits are granted via DEM approvals, all prior to request for a CRMC approval. Applicants find that variances, conditions, or special exceptions issued pursuant to one permit granting agency may be unacceptable to another. Towns may also rely on state review bodies to deny or condition controversial, politically visible projects.

Flexibility of response is constrained. Except with regard to larger projects eligible for pre-application review, expert advice on state requirements may be insufficiently available to municipal review agencies in the early formative stages of project design when technical input could be most readily utilized. CRMC, which prefers to review virtually complete designs at the end of the permitting process, is frequently placed in the position of requiring substantive changes in plans which have emerged from a lengthy review process involving hearings before various bodies. Once municipal approval has been obtained, the ability of state agencies to work with the developer to mitigate potential impacts is severely constrained, though agencies such as CRMC may have the broadest powers to consider environmental impacts.

As presently operated, the SAM plan coordinative review process needs improvement. Although well-conceived, the process is cumbersome, is consequently too limited in its application, and provides for uneven participation among involved review agencies. When several agencies or local government units must issue permits for a single use, a joint evaluation process should be established which provides efficient, consistent review, which considers incremental effects, and which involves all involved agencies in face-to-face conferences with applicants.

As a critically needed improvement in the governance process, applicants should be required to submit applications *first and simultaneously* to CRMC and Freshwater Wetlands, with copies submitted to the [recommended] local Environmental Protection Officer, who may perform a preliminary review.

Criteria and Standards Applied to Review

In existing non-point source related programs, criteria used as the basis of review need to be revised to give sufficient attention to ecosystem effects. For example, while ISDS Task Force Recommendations, and the recommendations of this study, attempt to broaden the consideration of groundwater impacts in DEM ISDS permitting, current regulations are oriented toward system function and relate primarily to public health considerations, rather than environmental consequences.

In a related vein, institutional arrangements which are presently in place to address non-point source pollution are unable to anticipate cumulative effects of development on water quality. DEM's anti-degradation policy is not presently being implemented in a manner which allows effective evaluation of incremental impacts. Similarly, CRMC has been unable to use its coastal ecosystem protection mandate to adequately evaluate and mitigate potential cumulative effects of degradation, or incremental losses of resource areas.

The limitations on review of cumulative impacts are exacerbated by the fact that DEM and CRMC jurisdiction is limited to projects exceeding certain thresholds which define the areal extent of the resource involved or the extent of anticipated development. These thresholds cannot adequately account for off-site impacts or for segmented development operations on large tracts.

Although existing programs provide for the use of buffer areas to reduce adverse impacts of specific developments and mitigate cumulative effects, buffer area designation is not meeting these needs in practice. Adequate buffers can effectively reduce the impact of development and provide critical wildlife habitat. Permit buffer requirements should be strictly enforced, and should establish buffers of sufficient dimensions to control pollutant inputs, and should adequately reflecting slope, topography, surficial material, and vegetative factors contributing to a buffer's effectiveness.

Formal standards and policy guidelines need to be established which clearly define permit review procedures, appeal review procedures, and procedures for granting variances, variations, and special exceptions. Regulatory guidance should incorporate performance standards relating to potential non-point source impacts (flooding, erosion, effects on neighboring land uses, impacts on adequacy of water supply, loss of habitat values, etc), allowing for a case-by-case contextual review of needs. The regulations should also apply simultaneous construction standards, to ensure that an effective basis for control is achieved, and that the administrative body has enforcement recourse prior to violation of the performance standard. Water quality standards and monitoring results should be used to establish the point at which a restoration effort begins and when it may be considered complete.

State administrative agencies need to give increased consideration to the close relationship between non-point source control and flood hazard management, evaluating cumulative impacts of hydrologic modification and hazard area alteration as key components of land use review and permit evaluation. Accounting methods should be used which evaluate watershed land and water resources as interrelated components of the hydrologic cycle.

Consistency

The inconsistencies evident between state and local provisions, among various agency provisions, and within the permit review processes are due in part to staffing limitations, and in part to the overlapping sequences of procedures surrounding review of permits and variances. Inconsistencies are also attributable to differences in technical training and inconsistencies in interpretation of mandate. There is a clear need to establish better coordination and consistency of approach among review bodies, through formal and informal means.

Incongruities among state agency practices are a major concern. For example, non-point source control efforts would be significantly enhanced by resolution of inconsistencies between existing non-point source initiatives and certain DOT policies, as well as the practice of DOT contractors. It is critical that a comprehensive review of state and federal highway construction safety and engineering requirements be undertaken to identify all inconsistencies between those provisions and the recommendations of the Stormwater and Erosion Control Committee and other state task force groups regarding non-point source pollution control practices.

Statutes in general should encourage consistent compliance on the part of local, state, and federal governments, by specifically including self-regulation of public uses. State regulations should apply consistent technical requirements and design and maintenance specifications for non-point source control measures. As a key aspect of improved consistency, provisions and requirements of state regulations need to be specifically referenced in the statewide building code, and in individual town ordinances and requirements.

Enforcement

Neither DEM nor CRMC have sufficient resources to monitor initial or long-term compliance with permit conditions. Full implementation of non-point control practices will require more than doubling the present engineering staff assigned to permit review and inspection at both DEM and CRMC, because of the need to undertake site-specific design and inspection surveys to ensure proper application of design criteria. Because non-point source controls are especially vulnerable to poor maintenance, permits should also ensure that responsibility for maintenance of permit conditions is established, along with a clear mechanism for transfer of responsibility at the time of a change in ownership.

A local enforcement and review fee should be required of all state permit applicants. The fee required should be commensurate with the size of the project and with potential watershed impact. The funds collected should be passed through to the town in question to support hiring of local environmental officers responsible for enforcement of

state wetlands and other environmental permit requirements. Pass-through of funds would be contingent on local review and inspection performance.

Mandatory training and licensing programs should be established for local building inspectors, surveyors, designers, contractors, state agency professionals, environmental officers, site evaluators, and others involved with designing, building, reviewing, or regulating facilities which contribute to non-point source pollution. To retain licenses and professional standing, licensees and others above should be required to attend periodic "review and update" workshops on state policy, regulations, and procedure.

Appeals

The regulatory appeal procedure applied in Rhode Island creates a presumption that the burden of proof should fall to regulatory bodies to justify enforcement of regulations. The appeal procedure is cumbersome and gives excessive power to the judiciary in interpreting technical regulatory mandates of executive agencies. **The Administrative Procedures Act needs to be amended to allow state administrative bodies to submit staff reports as fact, to provide the appeal procedure strict criteria of entry, and to ensure that the burden of proof falls to the applicant to demonstrate that strict application of the regulatory provisions at issue is unwarranted.**

Coordination

Communication and coordination among and within agencies needs to be cultivated. Present problems are deep-seated, and are due to competition for available resources, conflicts over interpretation of mandate and allocation of responsibility, friction between the legislature and the administration, regulatory inconsistency, and other issues. These divisions present serious obstacles to implementation of a successful non-point source control program. **An on-going forum for communication needs to be put in place to ensure improved consistency among state agency objectives and programs implemented.**

Reorganization

The Division of Planning should be moved out of the Department of Administration, given departmental status, and reorganized.

Responsibility for administration of the Coastal Community Assistance Program should be given to CRMC, and should be used to fund local programs which meet specific standards and selection criteria related to CRMC's mandate and program priorities.

An interagency executive level council should be formed to facilitate communication and cooperation among state programs concerned with land use and water resource management, and to monitor agency progress in improving program effectiveness.

A permanent interagency science advisory group should be formed to keep managers abreast of developing scientific information relevant to estuarine management, to create a forum for debate regarding the methods to be used in developing

reasoned management judgements under scientific uncertainty, and to assist in formulating a long-term research strategy for the Bay.

Local Authority to Undertake Land Management Initiatives Affecting Non-point Source Pollution

The Taking Issue

Rhode Islanders recently amended the State Constitution to require that the state's "takings" clause be construed in a manner as favorable to the environment and to the police powers of government as the U.S. Constitution permits. Nevertheless, results of this research effort indicate that a prevailing atmosphere of extreme regulatory caution has manifested itself in reluctance to deny or properly condition development permits, and in delay of action on key legislative initiatives affecting local and state authority.

Further research is needed in order to clearly define the factors which constrain and foster application of strong local controls, and to identify ways in which local initiative is affected, both positively and negatively, by the larger planning, regulatory, and judicial environment. Positive actions and outreach efforts need to be undertaken by state regulatory and planning bodies and by the Rhode Island Attorney General's Office to foster and support strong local water quality protection initiatives, given existing concern regarding restriction of authority.

Confirmation of Expanded Local Authority

There is a critical need to strengthen the existing local zoning enabling statute to provide towns full authority to address the impacts of land use on the public welfare, and to protect water quality. Towns must have full authority to enact zoning, subdivision and health ordinances and regulations as needed to exercise control over stormwater runoff, earth removal, erosion, landfills, on-site sewage disposal facilities, sewerage, marine discharges, water conservation, and other local concerns.

In order to make a comprehensive determination of local government roles and potential responsibilities in Bay water quality management, an in-depth inventory and analysis of local water-quality related initiatives needs to be completed. The analysis should involve a thorough inventory of water quality-related regulations at the local level, should describe funding and staffing levels, coordination mechanisms, and other factors contributing to the strength and weaknesses of local initiatives.

The inventory should be used as a basis in expanding local management authority, developing professional technical staff, establishing effective application and review criteria, and devising financing mechanisms which can support adequate review and enforcement efforts.

Local Participation in Program Implementation and Enforcement of State Requirements.

Although constraints are imposed by the lack of comprehensive zoning enabling legislation in Rhode Island, local governments have considerable authority over development, land use, and certain public health issues. Zoning and land and water

management controls are critically important in preventing groundwater pollution, protecting estuarine water quality, targeting growth toward resource areas capable of sustaining development, and preserving the unique amenity qualities of the Bay watershed system. As a result, **the management of land and water resources affecting the quality of Narragansett Bay depends heavily on the enactment and enforcement of local laws and regulations.** Several complicating factors in addition to the taking issue, however, have served to restrict the effectiveness of local initiatives.

An issue of key importance is the inadequacy of planning capability in many Bay basin communities. Although some towns have moved to develop qualified local planning staff within the past several years, many rapidly developing rural communities in the Bay watershed have staff resources which are inadequate to address difficult non-point source management issues. **Other Bay Project research efforts show that local planning capability is strongly correlated with development of effective non-point source control programs.**

Even where professional planning capability is available, **communication among local officials within municipalities is frequently insufficient.** Boards may be unaware of other town bodies' regulations, or may adopt contradictory policies. Ordinances are not consistently supported by the specific regulatory language of applicable boards or of related municipal by-laws.

State regulatory tools which have been made available are often incompletely utilized. Local provisions rarely go beyond the authority that state regulatory agencies exercise *in practice*. Especially where environmental controls are concerned, municipalities see themselves as organs of the state whose primary function is limited to increasing the potential efficiency of state initiatives. Certain local governments actively concerned with resource protection, however, feel insufficiently supported by state policy and practice. Towns look to CRMC, in particular, with its ecosystem protection mandate, to provide a strict regulatory interpretation which supports aggressive local action.

It is extremely important that towns make clear commitments to sound planning and sound wastewater management, using available land use regulatory authority to the maximum extent possible to implement non-point source controls. Wastewater Management Districts should be put in place as a key aspect of implementation. In areas unsuited to use of ISDS, lot sizing or other land management controls should be used to ensure adequate protection of water resources. To support local initiative, and to encourage consistent attention to resource protection needs, the Division of Planning and CRMC should prepare specific standards and requirements for revision of town comprehensive plans, including requirements for development of land use controls which are consistent with CRMC's coastal ecosystem protection mandate.

With regard to both state and local regulations, effectiveness is heavily dependent upon local building inspectors' interpretation of requirements, their commitment to ensuring that requirements are met, and the resources and time which are available to undertake inspections. Building inspectors should be licensed, as outlined above. **A new municipal professional position (Environmental Officer) needs to be established in most communities to provide technical inspection and permit**

tracking capability, liaison among municipal boards, advice and technical assistance, and coordination with Conservation Districts and state agencies.

Staffing

In all of the agencies concerned with non-point source related permitting and review, staff limitations and the burden of permit review create a focus on achieving efficient permit decision-making to the exclusion of broader program development, strategic planning, program coordination, or review of cumulative effects. Staffs need to be expanded to allow for rational development of consistent long-term resource protection strategies.

Staffs of Conservation Districts, the Division of Planning, DEM, and CRMC need to be expanded to ensure that technically qualified individuals are available to undertake "outreach" activities critically necessary to ensure successful implementation of the non-point source control and land use management strategies potentially undertaken by towns. Outreach should involve regular attendance/participation in meetings of town councils, planning boards, zoning boards, conservation commissions, wastewater management district boards, other town commissions, citizens groups, etc.

Sufficient funding and staff resources needs to be provided for Conservation Districts to enable the Districts to inventory sources, provide technical assistance to municipalities and farm operators, monitor BMP maintenance and effectiveness, and implement other programs as necessary to meet their expanding responsibilities in non-point source management.

Funding and Resource Allocation

Additional funding is badly needed for such functions as source inventorying, resource data gathering, working with local governments to encourage adoption of local ordinances and non-point source control measures, workshops, technical assistance for local government and interest groups, permit processing, and enforcement.

More effective use may be made of existing funds by:

- a) expediting preparation of available mapping and remote sensing resources, especially in critical areas, and where local governments have demonstrated a willingness to undertake regulatory efforts;
- b) delegating appropriate portions of problem definition, inventory, program administration, and enforcement responsibilities to local governments or other agencies where clearly established program roles have been defined, and where municipalities are willing and able to exceed the stringency of state level requirements;
- c) encouraging private resource protection by landowners and interest groups;

- d) shifting a portion of data gathering burden to developers through clearly defined data gathering or impact statement requirements consistent with applicable state guidance;
- e) imposing sliding scales of fees for development permits to help fund data gathering and enforcement activities;
- f) making optimal use of federal grants-in-aid, technical assistance, and data gathering capabilities.

In addition, state permit fees should be increased to provide pass-through funding to support local enforcement activities. Local and state permit application fee structures should provide for increased charges where incomplete applications must be returned and resubmitted.

Research and Assessment

A permanent research program needs to be put in place at the state level, building on the integrative, management-oriented approach of the Narragansett Bay Project. Research is needed to understand the functioning of the Bay system, to identify and evaluate linkages between individual and cumulative impacts and ecosystem function, and to improve monitoring efforts. The management-oriented research endeavors of URI, Brown, and other area research institutions must be fully and consistently supported. Management application and public education should be emphasized. Results should be capable of translation into simple and understandable documents, films, newspaper articles, and policy materials.

Analytical and predictive capability has been enormously improved during the past fifteen years of research on the Bay system, but many key parameters remain poorly understood. Technical analytical tools are needed to enable policy makers to more precisely characterize receiving waters and pollutant inputs. The Coastal Resource Center at the University of Rhode Island has begun the task of characterizing the biological, chemical and physical aspects of Bay estuarine waters, and is quantifying major pollutant inputs. However, on-going field surveys of pollutant inputs need to be expanded in order to target management response effectively, and to reflect changing conditions in the Bay basin as a complete system.

In order to refine non-point source management strategies so as to link particular watershed inputs to waterbody effects, it is important to determine the explicit water quality requirements of discrete marine uses. The Coastal Resource Center has begun this effort, using national water quality criteria data, literature surveys, and results of species-specific chronic toxicological studies in identifying requirements specific to important local species. This effort needs to be broadened, and fully coordinated with development of Rhode Island Geographic Information System (RIGIS) land use data development objectives.

Non-point pollution problems need to be defined based on characterization of the estuary and examination of marine use requirements. Problem definition should consider, to the extent possible, the presence and severity of combined pollution inputs, causal relationships among inputs and land use, levels of specific source categories of pollutants in receiving waters, interactions among contaminants in the estuary, and impairment of desired uses. A definition of

problems must consider both the health-based criteria which are used by DEM in setting water quality standards, and CRMC's ecosystem protection mandate.

Development of Specific Management Tools

For the use of local governments and state agencies, it is necessary to develop a simple methodology for conducting a preliminary or initial estimation of the magnitude of the non-point sources of pollution in a watershed and the impacts of those sources on quality of receiving waters. The preliminary model would be used in establishing a basis for selecting watersheds in which more detailed management-oriented research would be justified. The proposed methodology would consider storm-generated pollution, and as such would provide estimates of inputs due to CSOs as well as to urban runoff and sedimentation. A number of models of this nature have been prepared and applied with considerable success. Several methodologies (varying in data requirements, detail, and sophistication) have been developed by EPA's Municipal Environmental Research Lab since 1976.

Illustrated guidebooks should be prepared to be used in planning and zoning, and in designing and maintaining integrated non-point source management and control facilities. Separate handbooks should be prepared for ISDS/wastewater management and for stormwater/sediment management. The handbooks should be designed to provide guidance to town officials regarding pollution parameters and potential flood or health hazards associated with specific development categories, and to provide technical design, construction, and maintenance specifications for officials and developers.

The guidebooks would set out the methodology described above. They would also include a tabulation of potential applicability of specific requirements for different proposed land use developments (including, for example, residential, institutional, commercial, industrial, open space). The tabulation, and accompanying factors, would be intended to provide applicants as much pre-design specificity and predictability as possible regarding the requirements likely to be imposed. Further, clear guidance would be provided to town officials regarding issues relevant to planning and permit conditioning.

Monitoring

Agencies and institutions concerned with Bay quality, and with the impacts of Bay basin land use on resource viability, need to develop a comprehensive environmental monitoring program for the Bay. The monitoring program would serve four purposes: assisting researchers and managers in distinguishing between dynamic fluctuations of the estuary and impacts of human activities; facilitating agency decision-making by identifying problem areas and trends; measuring the success of the non-point source and other water quality programs; and providing an on-going record of the ecological status of the Bay.

In order to devise a monitoring strategy which best (and most cost-effectively) meets these various needs, it is necessary for agencies having monitoring needs to develop a consultative process for the long term, and to reach consensus on an inter-agency monitoring strategy. In addition, concerned agencies and institutions need to devise mechanisms by which water quality monitoring data can be most

effectively coordinated with developing capabilities of the RIGIS and other planning-related data retrieval systems.

DEM's effluent self-monitoring requirements for pollutant dischargers should be expanded to include non-point source parameters impacting receiving waters. Self-monitoring requirements should be adequate to ensure that a control system failure is detected in time for corrective action before standards are violated. Spot checking by DEM should give appropriate weight to verification of non-point source monitoring results.

Public Education

Although a range of different technical and management oriented best management practices are available to address non-point pollution control, the importance of public education and public involvement in making these efforts effective cannot be overemphasized. Where complex large scale non-point source problems are concerned, education is critical in developing public support of programs and in ensuring compliance with laws. Similarly, with respect to individual voluntary measures related to lawn management, household waste handling, pet waste management, and design of impervious areas, success will depend on the cooperation and understanding of the landowners involved.

A range of educational resources should be developed, including films, guidebooks, slide shows, newspaper articles, workshops, field tours and inspections, and training and direct contacts with interest groups, technical professionals and landowners. Rhode Island's special area management planning processes have consistently demonstrated the potential benefits of thorough public involvement.

Demonstration projects should be initiated in order to demonstrate the connection between the use of non-point source management practices and improvement in water quality. Every effort should be made to persuade the public that practices are worthwhile and worth supporting and maintaining.

A training handbook describing principles of ISDS function, potential water quality impacts, and the basics of ISDS protection and maintenance should be prepared by DEM. The handbook should be distributed to all applicants for ISDS permits, to towns for distribution to homeowners, and to the general public.

A similar public education handbook should be prepared by Conservation Districts, DEM, and CRMC describing stormwater management and erosion/sedimentation control issues, water quality and floodplain management impacts, conservation and control principles, need for plans, and applicability of local and state laws and programs. The handbook should reference available sources of information and government public information contacts.

Technical Education and Training

Many engineers, contractors, surveyors, drain-layers, sanitarians, ISDS installers, waste haulers, building inspectors, and other town and state officials, are insufficiently informed regarding ISDS and other non-point source pollutant factors. **All involved professionals need to fully understand site evaluation parameters in order to provide for proper design, installation, and maintenance of controls.**

Technical training and licensing programs need to be developed for practitioners and agency staff to ensure consistency of implementation.

A technical training manual should be prepared, describing the basis and rationale of site evaluation with respect to non-point source control, principles of ISDS function, principles of stormwater and sediment control facility function, issues of concern in installation and maintenance, and potential water quality impacts of failed systems.

A policy evaluation manual describing growth management issues should be prepared for town and state officials and the Rhode Island courts. The publication should reference available documentation regarding the costs of sprawl and the need to channel growth into areas where waste disposal can be made effective and safe, and non-point source impacts can be minimized. The handbook should address the need for protection of water supply aquifers and other natural resources, the pervasive impacts which non-point source pollutants can create across property lines and jurisdictional boundaries, the costs and benefits of controls, and other issues of concern.

PART 1: LAWS AND PROGRAMS: THE GOVERNANCE SETTING AND REORGANIZATION NEEDS

1.1 LAWS AND PROGRAMS AFFECTING NARRAGANSETT BAY WATER QUALITY

Introduction

In Rhode Island, government institutions concerned with Narragansett Bay pollution and fisheries management have been in place for more than 100 years. Institutions developed in response to emergence of specific problems, and put response-oriented decision-making mechanisms in place.

With changing program emphasis at the federal level, governing institutions in Rhode Island have undergone a rapid series of changes in emphasis, accompanied by changes in allocation of responsibility and alterations in institutional design. Institutions have responded to the dictates of public concern, to specific crises, to requirements imposed by federal legislation, and to the availability of federal implementation funding. New structural approaches have been built on a longstanding framework.

The patterns of institutional evolution are of key importance in understanding the issues influencing the functioning of the various involved agencies, their interaction, and the effectiveness of their operations. The Coastal Resources Center at the University of Rhode Island has devoted much attention to these issues, from the perspectives of historical development, evolution of authority, response to federal initiatives guiding environmental regulation, and other aspects of political science. These research efforts, and the methodology employed, have been of key importance in informing the process by which estuary governance is evaluated nationwide.

The present effort draws on the CRC results, but because it is designed as a *plan* and is of limited scope, has not been based on the rigorous analytical methods employed by political scientists. Conclusions and recommendations have been based on review of available literature sources, task force results, and numerous detailed interviews with officials, agency personnel, academics, task force members, and others close to the issues.

Note: In all sections of the plan, issues of particular importance are highlighted in bold-face. Recommendations are designated using side-bars. Those of very high immediate priority are denoted with three asterisks; ones of very high near term priority are denoted with two asterisks; ones of high longer term priority, but lower immediate term priority are denoted with one asterisk. All recommendations, however, are considered to be important in meeting program needs.

Background

The federal Water Quality Act of 1987 articulated a new policy goal for non-point source control. Section 319 of the Act states that:

...(7) it is the national policy that programs for the control of non-point sources of pollution be developed and implemented in an expeditious manner so as to enable the goals of this Act to be met through the control of both point and non-point sources of pollution.

Establishing new direction for the Act and authorizing significant federal financial assistance for the implementation of state non-point source programs, the legislation mandated a similar approach in information collection, assessment, targeting, and implementation as those taken in the new Surface Water Toxics Control, Estuary, Clean Lakes, and other program areas. States were specifically encouraged to ensure consistency among controls impacting the same water resources via development of State Clean Water Strategies. Building on existing state water pollution control activities, the Strategies could address in a strategic way the variety of sources, their inter-relationships, and the range of related water resources threatened.

In developing a program for non-point source control governance in the Narragansett Bay basin, then, it is necessary first to understand completely current efforts to provide water quality protection. The recent federal amendments recognized that understanding water quality laws and programs would be critical in designing a strategy for protection, and required that states include an identification and analysis of those laws and programs in preparation of new non-point source control programs.

Analysis of existing program capabilities requires (1) identifying laws and programs which are now available, and the adequacy of their "coverage" with regard to all non-point sources, and (2) evaluating the effectiveness of laws and programs now "on the books."

A broad range of programs, within the jurisdictions of several levels of government, affect NB basin water quality. These include regulatory programs, non-binding policy and guidance, technical assistance programs, policies and practices for specific resource areas and publicly owned land, and research and monitoring programs. Not only federal, state, and local levels of government are involved in administering these programs; special purpose districts and governments such as water supply districts, sewer authorities, conservation districts, and special area management-related entities also have important roles. The complex array of laws and programs has evolved in response to the diversity of pollution sources, as well as to changing perceptions of need at local and national levels through time. Tables 1.1 (a) through 1.1 (f) outline some key aspects of the structure of non-point source governance in the Narragansett Bay.

Federal Programs

Numerous federal regulatory and planning programs adopted over the past several years reflect a strong policy in favor of water quality protection, and a more general policy favoring protection of special resource areas such as coastal areas, wetlands and floodplains. Federal wetland and floodplain protection policy can be a major force in non-point source control, serving to establish national standards and to provide support for state and local initiatives. Two Executive Orders and new provisions in the Clean Water Act not only make major federal policy shifts, but also attempt to coordinate efforts of the U.S. Army Corps of Engineers, the Soil Conservation Service, the Bureau of Reclamation, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and EPA.

Because NPS pollution impacts essentially all categories of water resources, consideration of an overall water clean-up strategy is necessary, and programs are best categorized by pollution source. Lakes, estuaries, and groundwater, for example, act as sinks for non-point source and point source activities, and wetlands serve as both receptors and potential filters for a range of source types. As discussed in earlier sections,

Table 1.1a ISDS

	DEM	CRMC	DOH	PLANNING	LOCAL
Training				recomm.	
Licensing	x				
Critical areas	recomm.	x		recomm.	recomm.
Buffers	x	x	x		
Separation	x				x
Site evaluation	x	x			recomm.
Drainage	x				
Siting and Design	x	x			
Failure/Repair	x	recomm.	x	recomm.	recomm.
Change of Use	recomm.				
Additives	x				
Enforcement	x	recomm.			recomm.
Education	recomm.	recomm.		recomm.	recomm.

x= current role

recomm.= recommended role

Table 1.1b Agricultural Sources

	DEM	SCS	ASCS	Cons. Districts	LOCAL
Pesticides	x				
Fertilizers					
Sediment	recomm.			x	x
BMP Design		x		x	
BMP Installation		x		x	
BMP Inspection		x		x	
BMP Funding	x		x		
Wetlands Alteration	x				
Acquisition	x				x
Education		x	x	x	

x= current role

recomm.= recommended role

Table 1.1c Sediment/Erosion

	Wetlands Sec.	Water Res.	OEC	Planning via NFIP	CRMC SAMPs	SCS/Cons. Dist's	LOCAL
Guidance			x		x	x	
Impact Evaluation	x			recomm.	x	x	
Water Quality Cert.		x					
Design Recommendation	x		x		x	x	
E & S Plans	recomm.				recomm.	x	recomm.*
Permit Conditions	x				x	recomm.	
Inspection	i				i	recomm.	i
Program Review			x	via NFIP	recomm.	x	
Education			x	x	recomm.	x	
Federal Law		x					
State Law	x				recomm.	recomm.	
State Policy	x				recomm.	recomm.	
Local Ordinance					SAMPs	x	x

x = current role

recomm. = recommended role

i = needs improved implementation

* approved program

Table 1.1d Stormwater

	Wetlands Sec.	Water Res.	OEC	Groundwater	Planning via flood mgt.	CRMC SAMPs	SCS/Cons. Dist's	LOCAL
Guidance								
Impact Evaluation	x		x	recomm.	recomm.	x	x	
Water Quality Cert.		x						
Design Recommendation	x		x	recomm.		x	x	recomm.*
SW Plans	recomm.			recomm.				
Permit Conditions	x			x(UIC)		x	recomm.	
Inspection	i					recomm.		recomm.
Program Review			x		via flood mgt	recomm.	x	
Education			x		x	recomm.	x	
Federal Law		x						
State Law	x					recomm.	recomm.	
State Policy	x						recomm.	
Local Ordinance						SAMPs	x	x

x= current role

recomm.= recommended role

i= needs improved implementation

* approved program

Table 1.1e Floodplain Management

	CRMC	Planning	FEMA	Local	RI Bldg. Comm.	SCS/Cons. Dist's
Siting	x		x	x		x
Design	x		x	x	x	x
Construction	state code		x	state code	x	
Management	same as NFIP	x		recomm.		
Insurance			x			
Repair	x			state code	x	
Replacement	x			state code	x	
Program Review	recomm.	x	x			x

x= current role

recomm.= recommended role

Table 1.1f Marinas

	DEM Wat. Res.	DEM/RIPDES	CRMC	Corps of Eng.	EPA	Coast Guard	LOCAL	Planning
Impact Evaluation	x	x	x	x			x Guide Plan	
Water Quality Cert.	x							
Designated Use	x		recomm.					
Water Area Use	recomm.		x				x	recomm.
Coastal Land Use			x					
Direct Discharge		x			x			
Permit Conditions	x	x	x	x				
Dredge/Fill	x*		x	x	x		certain towns	
Dredge Spoil Disp.	x*		x	x	x			
Toxics		x			x			
Bulk Oil Transfers			x				recomm.	
Policy Devel	x		x					
MSD Design						x		
MSD Perform						x		
Oil/haz Discharge From Vessels	x		x		x			

x = current role

x* = Several divisions within DEM

recomm. = recommended role

distinguishing point from non-point source inputs has become a major challenge for state agencies, and will continue to present both technical and management difficulties. As a first step, many states have attempted to estimate point source contributions, and the potential of point source control programs.

The Clean Water Act required that states undertake major pollution control planning efforts under EPA oversight. Partial federal funding was made available to support states engaging in area-wide 208 planning (to develop statewide control of point and non-point sources), Section 303e river basin planning for major watersheds, and Section 201 sewage facility planning for municipal districts to be supported by federal construction grant monies.

The Federal Water Quality Act (WQA) regulates industrial and municipal discharges and other point sources. While the regulatory program is administered principally by EPA, many functions may be delegated to states that have developed equivalent or more stringent programs. In the Narragansett Bay basin, both Rhode Island and Massachusetts have delegated programs, which are administered under EPA oversight.

Under the federal National Pollutant Discharge Elimination System (NPDES), national discharge standards based on available and affordable technology were to be developed on a nationwide basis for each industry group. Discharge standards for some industries are still incomplete, but technology based standards have served as the principal basis for attainment of U.S. pollution abatement goals.

Industrial and municipal dischargers releasing pollutants directly into surface waters are required to obtain a permit containing numerical effluent limits for their discharge. Indirect dischargers (releasing pollutants into sewage systems or underground water) must obtain state discharge permits pursuant to applicable state law.

Roles of Involved State Agencies in Control of Point Sources

In Rhode Island, the Rhode Island Pollution Discharge Elimination System (RIPDES) program is administered by DEM, which applies two sets of standards to arrive at permit discharge limits: water quality standards and technology-based standards. As required elsewhere in the U.S. by the Water Quality Act, Rhode Island waters have been evaluated and assigned classes based upon existing and desired water quality conditions. Designations reflect potential uses, including drinking water, shellfish harvesting, swimming, etc. Rhode Island's anti-degradation policy prohibits the degradation of a waterbody below its designated use unless certain needs are shown. Water quality classifications are used in evaluating whether applicable discharge limitations are adequate to achieve the state's own water quality goals, and in estimating potential impacts of a range of development projects potentially affecting water quality.

With the advent of technology-based controls, and eventual delegation of the NPDES program, DEM assumed responsibility for control of point source discharges, building a new regulatory framework on the authority of Rhode Island's antiquated 1920 pollution control law. DEM established use goals or "designations" for specific water areas, based on the desired suitability of those waters to serve as viable habitat, support fish and shellfish harvesting, meet recreational demands and drinking water needs, and assimilate waste. In 1975, numerical and qualitative criteria were set, defining the minimal allowable conditions which support desired "designated" uses.

Rhode Island's surface water classification system is as follows:

Freshwater: Rivers and Streams, Lakes/Reservoirs/Ponds

Designated Use Support

(Uses are support when water quality condition meets water classification goal)

Class A - drinking water supply

Class B - public water supply with appropriate treatment

- agricultural uses
- bathing, other primary contact recreational activities
- fish and wildlife habitat

Class C - boating, other secondary contact recreational activities

- fish and wildlife habitat
- industrial processes and cooling

Saltwater: Estuaries and/or Oceans

Designated Use Support

Class SA - shellfish harvesting for direct human consumption

- bathing and contact recreation
- fish and wildlife habitat

Class SB - shellfish harvesting for human consumption after depuration

- bathing and primary contact recreation
- fish and wildlife habitat

Class SC - boating, other secondary contact recreation

- fish and wildlife habitat
- industrial cooling
- good aesthetic value

The designation process has always been controversial, for a number of reasons. First, it required states to translate the national goal and deadline for achievement of "fishable and swimmable waters" into a geographically based regulatory framework before sufficient data were available to understand [then] current water body conditions, including the functioning of the estuary and its ability to assimilate waste. Discharge reduction stipulations for industries and sewage treatment works were based strictly on the difference between existing conditions and adopted criteria. The designation process did not address the practicality of water quality goals. The goals thus provided little guidance to regulators attempting to make practical decisions in an orderly, predictable way.

The Clean Water Act initially required that states electing to take program delegation periodically reevaluate applicable water quality standards and classes, and submit program results to EPA. In 1981, Congress specifically amended the Clean Water Act to address the problems revealed through experience with technology-based controls, and to

encourage states to prioritize receiving waters, concentrating their attention and financial resources on those in the worst condition.

States were required to review standards by 1984 to determine whether designated uses were being attained and whether they were attainable. The Continuing Planning Process, established by Section 303 of the Clean Water Act, stipulated that water quality standards should be regularly revised to consider new data, changes in financial resources, and technological change, and to address new pollution problems.

In an effort to encourage accurate definition of priorities, the law stressed use of:

- a) water quality limited segments to designate areas where technology- based effluent limits had proved inadequate;
- b) total maximum daily loads (the largest loading of pollutants compatible with a designated use);
- c) waste load allocation (loads allocated to individual pollutant sources to aid in evaluation of violation of the standards);
- d) effluent limits, specifying the maximum pollutant loading which a discharger can legally contribute to a water body.

A broad range of pollutant sources are to be considered by states in revising standards, according to the review process suggested in the Federal Register (October 29, 1982). The process accounted for consideration of the adequacy of non-point source controls only at the end of the process, however, after the difference between the allowable daily load and the existing load had been computed and allocated among the sources of pollution in the drainage basin feeding a water body segment.

The Role of Involved Agencies in Non-point Source Management

Responsibility for various aspects of non-point source management ranges across several state agencies in Rhode Island and extends to local government. Existing and recommended allocation of responsibility is briefly summarized in Tables 1.1 (a) through 1.1(f), which follow.

Part of the complexity of Rhode Island's regulatory framework is due to the fact that federal pollution control strategy shifted from placing emphasis on tailoring control efforts to local conditions toward reliance on uniform technology-based controls. In the 1970's, the Department of Administration's Division of Planning (then called the Office of Statewide Planning) held a key position on water quality planning and implementation, assisting towns in preparation of 201 Facilities Plans and developing the Areawide Water Quality Management Plan for the state in 1978.

The Division of Planning presently addresses numerous issues relating land use and water quality. Of key importance is the Division's current project to develop a Scituate Reservoir Watershed Management Plan. The Division also addresses land use and water resource issues through its State Guide Plan Overview, the 208 Areawide Water Quality Management Plan, and several 303 Basin Plans. Issues include conservation and open space planning, waste management, transportation, economic development, housing, water

resources, geologically specific water management plans, reuse of surplus Navy lands, recreation, and other related concerns.

DEM has several program responsibilities that relate to non-point source control, which are shared among several divisions. As outlined in Section 1.2, the Office of Environmental Coordination has a principal role in coordinating the State's Non-point Source Pollution Management Program. Groundwater protection efforts are primarily the responsibility of the Groundwater Section within the Division of Groundwater and Freshwater Wetlands, which also houses the ISDS Section and the Freshwater Wetlands Section. The latter sections have major responsibilities related to non-point source control.

The Division of Water Resources handles water quality certifications under Section 401 of the Clean Water Act, and addresses water quality problems associated with combined sewer overflows. (Combined sewer overflows were specifically omitted from the original research scope of this effort, but must be carefully considered in development of stormwater runoff and erosion control strategies, and other non-point source management efforts.) The Division of Water Resources also encompasses the Department's oil spill emergency response program, and the clean lakes program.

Within the Division of Air and Hazardous Materials are landfill regulation, acid precipitation, chemical spill emergency response, and hazardous waste site monitoring. The Ocean State Cleanup and Recycling Program (OSCAR), run out of the DEM Office of Environmental Coordination, manages the state's recycling and litter control programs. The Office of Environmental Coordination also manages DEM's review of Environmental Impact Statements and other large projects not requiring an EIS. The Division of Coastal Resources monitors and regulates shellfish quality, while the Division of Fish and Wildlife has non-point source responsibilities relating to acid precipitation and aquatic weed control.

CRMC's ecosystem protection mandate affords it considerable authority to address a range of non-point impacts. Section 300.2 and 300.3 of the Red Book give CRMC authority to establish permit conditions so as to require management of stormwater and emplacement of erosion and sedimentation controls. A potentially important tool in control of urban runoff contamination and pollution of shorefront waters is provided by the requirement that all bulk-oil transfers involving ships and facilities require a permit from CRMC. CRMC addresses stormwater management and erosion and sediment control in more detail in specific Special Area Management (SAM) plans. Plans outline management policies and regulations relating to stormwater control, require development of stormwater management plans as part of the permitting process, and set criteria for performance and design standards to be applied, citing specific publications as design references.

The breadth of CRMC authority allows the Council to evaluate appropriateness of land uses in areas influencing the coast, an extremely valuable tool in control of non-point sources, which are inseparably related to land use. CRMC's role in implementation of floodplain management policy gives it power to regulate growth and redevelopment in hazard-prone coastal areas and to encourage local consistency with sound hazard area management policy.

The Conservation Districts in the Bay basin provide critical institutional linkages and perform numerous important functions in non-point source control. Districts work closely with the U.S. Department of Agriculture's Soil Conservation Service (SCS) and Agricultural Stabilization Service (ASCS) in providing assistance to farm operators in

developing soil erosion control and agricultural waste management plans. Municipalities have become strongly dependent on the districts, relying on district technical assistance in review of site development plans and other implementation efforts. Districts also provide assistance in the review of Environmental Impact Statements and non-point source control plans developed for proposed state and federal projects in the district, including highway projects.

Local zoning enabling authority, provided by the Rhode Island State Zoning Enabling Act (RIGL 45-24), gives towns authority to address the impacts of land use on the public welfare. Local governments may use police power to protect public health, welfare, and the public purse. At present, non-point source pollution may be addressed through zoning, subdivision regulations and other controls.

Strengthened zoning enabling authority is needed, however, to confirm local government authority to use zoning, wastewater management ordinances, health regulations, and other ordinances, by-laws and regulations to exercise control over: stormwater runoff, earth removal, erosion, landfills, on-site sewage disposal facilities, sewerage, marine discharges, water conservation, and other local concerns.

1.2 REQUIREMENTS OF THE WATER QUALITY ACT OF 1987: **CURRENT STATE INITIATIVES**

The Office of Environmental Coordination (OEC) within DEM is responsible for preparation of the state's Non-point Source Management Program, using federal funds made available by the Water Quality Act of 1987. The Office of Environmental Coordination is preparing a Non-point Source Assessment Report and Management Plan, and will coordinate continued non-point source related activities and responsibilities. In these efforts, OEC is coordinating with other DEM divisions, and with the Division of Planning, the Coastal Resources Management Council, the Narragansett Bay Project, and the US Soil Conservation Service. A non-point source advisory committee, composed of representatives of the participating agencies and selected citizens' watershed and environmental organizations is being established to facilitate coordination and communication (DEM, 1987).

The Non-point Source Assessment Report (completed April 1, 1988), and Rhode Island's Draft Non-point Source Management Plan (completed August 3, 1988) identified known surface waters and groundwaters impacted by non-point sources of pollution. The Assessment Report categorized these waters as to whether current site-specific ambient data can be applied to analysis ("monitored waters"), or other data will be used ("evaluated waters"). To the extent possible, the assessment report also identified, on a watershed basis, high quality waters threatened by non-point source pollution, based upon analysis of water quality trends and/or land use activities. The report also identified the categories and sub-categories of non-point sources, generally describing categories which are a source of concern statewide. Although problems will be characterized specifically as data analysis proceeds, the Scituate Reservoir has already been designated as a high priority watershed.

The categories of non-point source pollution which have been considered to represent concerns justifying evaluation during the assessment include, at a minimum:

- 1) Surface runoff from urbanized or urbanizing areas
- 2) Individual Sewage Disposal Systems
- 3) Soil erosion and sedimentation from construction sites, including highway projects
- 4) Use of fertilizers and pesticides
- 5) Road salt application and storage
- 6) Agricultural and silvicultural/forestry activities
- 7) Underground storage tanks

(Of these, the present research effort omits consideration of silvicultural activities and underground storage tanks, but considers, in addition, impacts associated with marinas.)

In order to link non-point sources with potentially available controls, the assessment report will describe the process by which best management practices will be selected and will describe existing state and local programs having non-point source control authority. Note: The term best management practice (BMP) means a practice, or combination of practices, that is determined by a State (or designated areawide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation, to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals. (40 CFR Part 130)

Using the assessment results, DEM will identify priority waterbodies for program implementation efforts, focusing efforts on sources which are either ineffectively regulated or unregulated. Criteria to be use in setting priorities among watersheds and source categories include availability of information, the value of the resource as water supply or fish and wildlife habitat, willingness of town officials and local interest groups to participate in non-point source control efforts, cost effectiveness, technical feasibility, availability of funds, and other factors.

DEM anticipates that the state will use a dual approach in identifying and implementing best management practices. Projected activities at the state level include coordination and strengthening of ongoing programs, regulatory revisions, and preparation of educational materials. Intensive site-specific implementation of BMPs will proceed on a watershed or sub-watershed basis in targeted project areas, as developed priorities dictate. DEM hopes to develop a program design which will provide flexibility in its application, so as to allow for revision of priorities and program strategy as experience is gained and new data becomes available.

1.3 RECOMMENDED REORGANIZATION STRATEGY

Introduction

Of the many items and issues on the action agenda of the Governor's Land Use Commission, review of local government land use control authority and revision of the state's permitting process have received primary attention.

The following sections make recommendations regarding reorganization and re-allocation of responsibilities needed in order to improve the functional consistency of state programs, to rationalize the permit review process, and to enable government bodies to more effectively fulfill their existing responsibilities.

Recommendations

Procedural Recommendations to the Office of the Attorney General

Undertake an analysis to determine how the budget process may be revised and rationalized. The allocation process presently places program offices within the same department in the position of competing with one another for scarce funding on an annual basis. This procedure exacerbates communication difficulties among program units, may limit cooperation, and restricts the ability of executive decision-makers to initiate new program efforts absent outside funding sources. Consequently, development of outside funding sources and temporary bond issues may be emphasized in areas where firm enduring financial commitments from the state government itself are needed.

Undertake a thorough examination of personnel management practice and procedure (including initial qualification review, hiring practice, performance review, seniority, compensation and benefits, etc.) to determine how current state personnel policy and practice is influencing staffing capability. Rapid turnover among state agency technical personnel is presently hampering the agencies' ability to meet program development needs, provide for optimal permit management and review, respond to citizens' complaints in a timely fashion, and address other important agency functions.

DIVISION OF PLANNING

Remove the Division of Planning from the Department of Administration and establish it as a separate Department. Expand the Division staff and reorganize the Division along technical lines so as to ensure that the following technical planning responsibilities may be fully met:

- providing environmental and flood hazard area planning and growth management assistance to local communities,
- providing objective legal advice to communities regarding the use of zoning and land use controls, imposition of growth management and/or wastewater management measures, enactment of moratoria, etc.

- developing and implementing technical standards for review of local comprehensive plans,
- revising and implementing the Narragansett Bay Basin Plan, 303e basin plans, 201 facilities plans, and environmentally-related elements of the State Guide Plan,
- serving on CRMC subcommittees and participating in CRMC permit review
- defining environmental policies to be applied statewide in local land use decision-making
- working with DEM to develop the RIGIS database.
- assisting towns in planning for other community needs and interests, including economic development, special land uses, transportation, infrastructure, utilities, other facilities planning;
- other planning activities currently handled by the Division of Planning.

LAND USE IMPACTS COUNCIL

Form a *Land Use Impacts Council* (LUIC), as an adjunct committee to the State Conservation Committee, to include equal executive representation from DEM, the Narragansett Bay Project, CRMC, DOH, the Division of Planning, DOT, the legislature, local community planners, the Conservation Districts, and interest groups. The Council would provide an on-going forum for review and evaluation of land use issues, and for circulation of agency research results.

A key function of the LUIC would be to track agency progress in responding to needs and recommendations articulated by task force groups, outside study committees, citizens advisory committees, inter-agency policy development groups, etc. The need for a discussion forum is evidenced by these groups' current efforts to formalize follow-up functions in order to maintain contact and monitor progress in implementing recommendations.

In particular, there is a very clear need to provide a follow-through mechanism to ensure that task force results are published, and presented for public review and comment, and that the status of recommendations is reviewed on an annual or biannual basis. If talented citizens (and academics in particular) are going to continue to involve themselves in investigative and advisory roles, they must be assured that the results of their efforts will be considered and acted upon.

Similarly, the LUIC would have as a high priority objective the clarification and formalization of agency procedures. Within its first year of operation, the LUIC would undertake a review of Coastal Council membership and appointment procedure, and would prepare qualifications criteria and public review procedures to be applied in selection of Council members. Finally, the LUIC would provide an important expert forum from which to educate the legislature regarding relevant issues and within which to draft and review proposed legislation.

SCIENTIFIC ADVISORY GROUP

Form a board of experts to provide scientific advice to agencies involved in non-point source management, to the legislature, and to the executive. The board would educate these groups as to management ramifications of emerging scientific results, and would assess how available scientific information should best be applied in decision-making under uncertainty. The parent board could work in concert with embayment-specific or issue-specific committees or sub-committees which would provide expertise in response to discrete problems. On a continuing basis, the board would assist client groups in evaluating scientifically-based policy decisions affecting the Bay, and would provide guidance in approaching risk-benefit questions and estimating information "return" to research expenditure.

RIDEM

Expand the role of the Office of Environmental Coordination to enable the Office to operate as a pro-active strategic planning group responsible for evaluating the impacts of DEM internal decisions and the decisions of hearing officers on other state and local pollution management efforts. Expand OEC staff authority to work with other agency decision-makers in strategic planning and to facilitate advance coordination among relevant institutions.

Form a new Water and Land Management Section within the Division of Water Resources which would assume a broad resource management role within the agency. The new administrative body would:

- coordinate results of all DEM monitoring and research programs;
- set up a data management system to be used by all DEM Divisions and to be coordinated with the recommended Technical Planning Sector at the Division of Planning;
- classify wetlands and other water bodies according to a resource value, scarcity, and vulnerability designation process;
- develop a framework allowing for significantly strengthened consideration of cumulative effects, as recommended in other sections;
- develop a water quality characterization process to be used to link biological integrity with effects of present use and potential use to the maximum extent possible. Waste load allocations and effluent limits should be established to coordinate the simultaneous imposition of point source discharge limits and non-point source controls; and
- complete water quality certifications, developing guidelines and procedures as recommended in the subsequent section on water quality certification.

CRMC

Responsibility for administration of the Coastal Community Assistance Program should be given to CRMC, and should be used to fund local programs which meet specific standards and selection criteria related to CRMC's mandate and program priorities.

Responsibility for enforcement of CRMC program requirements should be removed from DEM and given to CRMC. Trained enforcement officers on the CRMC staff need to be available to undertake inspections and other field enforcement duties.

RIDEM AND CRMC

In coastal as well as inland areas, DEM and CRMC need to develop an improved method of addressing incremental and cumulative effects of development, which specifically considers the connections between land uses/development impacts and alterations in resource values. The methodology should evaluate disturbances and effects, and subsequent impacts on resources, accounting for the multiplicative or interactive effect of separate disturbances. Assessment of cumulative impacts must be very coordinated with monitoring and data management activities, so that optimal use may be made of baseline data and subsequent monitoring results in evaluation.

Very fundamental policy decisions need to be made as to "how much is too much" for an ecological system, so that managers and permit evaluators can make permitting decisions based on resource vulnerability. Other states and the U.S. Fish and Wildlife Service have attempted to develop vulnerability indices for use in evaluating cumulative impacts. The U.S. Fish and Wildlife Service, for example, approaches cumulative impact evaluation via its review of the significance of project-induced alterations.

The methodology developed to address cumulative impact review should be consistent with the recommendations, which concern rationalization of the water use and water quality impact evaluation process between DEM and CRMC.

Develop guidelines setting specific standards to govern the siting and design of development so as to consider water quality concerns as a basis for siting, operation, and maintenance.

Utilize the Section 319 Non-point Source Program and the 205(j) Basin Planning framework in establishing priorities and in articulating detailed water quality goals to guide non-point pollution efforts in specific areas. Develop a planning process for these selected areas which clearly links defined water quality goals to non-point pollution control programs and requirements.

Establish a pre-development and post-development water quality monitoring program for use in critical watershed areas and estuarine waters along the lines of the I-99 construction area monitoring effort initiated by DEM and DOT in Woonsocket. Define how water quality measurements will be used in evaluating the adequacy of stormwater, erosion, and sedimentation control measures and facility designs. Define how water quality measures will be used in measuring adequacy of facility

performance through time, and in initiating enforcement procedures where maintenance schedules are not adhered to and non-point source controls are allowed to become insufficiently effective.

As an aspect of the preceding responsibility, establish a two-part management oriented water quality standard in which each agency responsible for regulating activities with a potential for contaminating waterbodies would establish both a preventive action limit and an enforcement standard. The preventive action limit would be a small fraction of the companion enforcement standard; violation of this limit would trigger an examination of possible responses by the administrative body having jurisdiction over the source. Depending on the actual or potential seriousness of the contamination, the agency could require site-specific remedial action, revise agency rules to address the problem, or take no action. Violation of the enforcement would trigger an immediate enforcement action against the violator.

LOCAL GOVERNMENTS

Strongly consider creating a new town officer position to assist town boards in coordinating health-related, land use, and environmental concerns. The Environmental Protection Officer could be designated an ex-officio member of the planning board or the town council, and would serve as an agent of the town with the flexibility and authority to initiate regulatory and legal action. The Environmental Protection Officer would assist the building inspector and the staff of the building department in ensuring compliance with state and local resource protection requirements.

The Environmental Protection Officer, and the Officer's staff assistants would be licensed professionals who had successfully completed training in biology, ecology, environmental science, environmental engineering, forestry, or a related field.

The officer would serve as a liaison between town and regional bodies having jurisdiction over land use and water quality related concerns, including the town council, the planning and zoning boards, the conservation commission, the wastewater management district, the department of public works, and the soil and water conservation district. The officer would attend board meetings, work with related state agencies, assist applicable boards in reviewing resource inventory assessments and permit applications, and foster communication among these groups.

Copies of state coastal and wetlands alteration permit applications (and other environmental permit applications as appropriate) would be submitted to the Environmental Protection Officer, who would examine them for completeness and accuracy, identifying application deficiencies requiring correction. Upon payment of a supplemental review fee to cover administrative and research costs, permit applicants would be able to obtain from the officer a preliminary non-binding review of the substantive adequacy of the application, and an assessment of potential adjustments which would likely be necessary in order to comply with state requirements.

The officer would familiarize himself/herself with state permitting requirements, and would be required to attend periodic workshops held by the state permitting agencies to update environmental protection officers and local building inspectors regarding

adjustments to state requirements. The initial review function would serve dual purposes: reducing the volume of repeat applications and enabling local officials to develop a local data base and improve capabilities with regard to local resource protection needs.

Dedicated permit fees, land transfer assessments, fines collected as a result of enforcement actions, etc. could be used to fund these positions.

PART 2: APPROACHING NON-POINT SOURCE POLLUTION CONTROL VIA SOURCE CONTROLS

2.1 INDIVIDUAL SEWAGE DISPOSAL SYSTEMS

Introduction

When properly sited, designed, installed and maintained, individual sewage disposal systems (ISDS) can be used to treat household waste simply and effectively. However, discharge of improperly treated effluent to groundwater and surface waters can create significant hazards to human health, can degrade potable water supplies, and can promote eutrophication leading to loss of valuable fisheries habitat and closure of recreational areas.

ISDS effluent contains several types of pollutants including: nutrients; conventional pollutants such as suspended solids, oil, and grease; pathogens, including bacteria and viruses; and toxic chemicals such as synthetic organics and metals. Of these, nutrient and pathogen loadings present the greatest concern as pollutants of receiving waters, followed by organics. Suspended solids and metals should be removed by a properly functioning system. Oil and grease may clog leach fields, limiting treatment capacity.

Although scientific knowledge concerning the biochemical fate of these pollutants, and their interactions in waterbodies, is incomplete, sufficient data exists to justify a high degree of concern where dense development has led to groundwater contamination, and where effluent is transported into poorly flushed waterbodies or embayments. These issues present potential health hazards in the Bay watershed as well as in all affected portions of the state.

THE ISDS TASK FORCE

In Rhode Island, recognition of existing and potential hazards presented by ISDS led to the formation of a technical advisory group known as the ISDS Task Force, which met between April, 1986 and January, 1987 to investigate alternative solutions to problems of older, substandard septic systems and to develop siting and design criteria for new systems in sensitive areas.

This group of engineering, planning, and research professionals formed three subcommittees to research, evaluate, and prepare preliminary findings with respect to ISDS maintenance and education, regulations for new systems, including those in critical areas, and innovative systems. In approaching their tasks of evaluation, the subcommittees undertook surveys of current literature and other state regulatory programs to assess effects of ISDS, and alternate controls.

The subcommittees prepared analyses of current research findings showing ISDS as sources of non-conventional pollutants, microbial contaminants, and excess nutrient loads. Other state ISDS regulations were examined, innovative systems were evaluated, and state and local regulations pertaining to ISDS maintenance were reviewed. Using these research results, the Task Force prepared a comprehensive set of findings and recommendations to address means to control effluent from ISDS.

Principal recommendations of the Task Force comprise the following elements:

1. **Improve management of existing systems through community-operated programs to require regular septic tank pumping in conjunction with more aggressive enforcement of state ISDS standards. This is authorized by 1987 legislation enabling communities to establish ISDS maintenance districts. At the state level, authority for ISDS inspection and enforcement should be consolidated at DEM, with provision for necessary funding.**
2. **Establish special siting and design criteria for new systems in critical areas to address buffers, separation distance to groundwater, filled systems in shallow soil, use of subdrains and impacts of large systems and subdivisions.**
3. **Update minimum standards to include criteria for review and approval of variance applications, improved site suitability and system sizing methods to reduce reliance on percolation tests, prohibition on use of system additives and other revisions applicable state-wide.**
4. **Allow certain innovative technologies such as mound systems as replacement systems where conventional design is not possible.**

The specific objectives of the Regulations Subcommittee were to review and recommend modifications to the DEM Rules and Regulations for ISDS, focusing on sensitive areas where minimum standards have been found to be insufficient. Particular attention, therefore, was accorded to development of standards for the recommended critical areas (Item 2, above).

For the purposes of the Task Force analysis, critical areas were identified as "surface/groundwaters that, due to natural limitations, require protection from ISDS impacts because of their value for public water supply, recreation, shellfisheries, aquatic habitat and other uses."

The Subcommittee selected four specific critical areas, having specific characteristics representative of the four area types, as priority critical areas where model standards for ISDS design, siting, and maintenance would be applied. These priority critical areas include the Scituate Reservoir Watershed, the Coastal Pond Watershed, groundwater recharge zones of municipal water supplies, and groundwaters used for individual wells.

Based on Subcommittee findings, the ISDS Task Force submitted a set of findings and recommendations addressing specific deficiencies in regulations pertaining to ISDS design, siting, and maintenance. Although the Task Force findings indicate that implementing these recommendations in the Scituate Reservoir Watershed and Coastal Ponds Watershed is of critical importance, the Task Force presented its recommendations as being "applicable to general ISDS permitting statewide" (Regulations Subcommittee Final Report, p. 17).

The Task Force findings and recommendations were formally presented to RIDEM in January 1987. DEM assumed the responsibility of preparing regulatory language and administrative procedures to implement the recommendations, and has proceeded with that

process internally. Although the Task Force Report has been circulated under public notice requirements, and by request, it has not as yet been published for widespread public review and evaluation.

The findings and recommendations of the Task Force are strongly supported by the findings of the present research effort, and are supported by the recommendations presented below. The Task Force Report, and attached sets of Subcommittee reports, recommendations, and references, should be considered an essential planning and analytical tool for communities addressing ISDS issues.

In order to make this valuable planning resource widely available, the full Final Report and all Subcommittee Reports should be published in their entirety by DEM and distributed to town officials, building inspectors, and interested citizens. To enhance the accessibility of the Task Force findings and other materials for the use of local officials and project designers, the data should also be organized into a set of tables which could easily be displayed, referenced, or used in the field.

ISDS AS POLLUTANT SOURCES: ISSUES OF CONCERN

ISDS pollutant classes of concern, and their effects, are summarized in the following sections.

Non-Conventional Pollutants

A 1980 EPA report identified a total of 23 priority pollutants contained in household wastewater which are likely to enter septic systems due to disposal of many commonly used household products. In addition to wastewater disposal sources, several potentially toxic substances are introduced through the use of septic system cleaners.

According to data assembled by the State of Connecticut and reported by the ISDS Task Force, two out of three of the types of septic cleaners commonly available are ineffective, and all pose risks either to the proper functioning of the system, or to the groundwater, or both. In general, additives can affect the capability of the soil to transmit effluent, causing soils to flocculate, clogging leachfield lines. Biologically-based cleaners (bacteria, enzymes, yeast) are ineffective in the anaerobic environment of the system and contribute to nutrient loading. Similarly, acids and bases interfere with the process of biodegradation which forms the basis of the system's function, while damaging the structure of the tank.

The third type of cleaner, containing synthetic organic constituents, is of particular concern, not only from the standpoint of original constituents, but also due to the chemical byproducts of anaerobic reactions in the tank. Of the organic solvents contained in these septic system cleaners, several, including known carcinogens, have been found to present significant health risk to humans exposed at extremely low part-per-billion levels. Studies conducted in Connecticut and New York have clearly linked use of system cleaners with groundwater contamination, using key contaminants of significance.

Experimental studies suggest that organics are very ineffectively treated during typical septic tank retention periods. DeWalle et al. (1983) and Tomson et al. (1984) sampled and analyzed constituents of distribution boxes and groundwater affected by effluent. Trace levels of several priority pollutants were identified, leading the authors to conclude that

septic systems clearly presented a major potential source of groundwater pollution, and that current design practices, including well separation distances, might be inadequate to protect public health.

Tomson et al. (1984) presented specific findings regarding trace level organics: a) many tank effluents contain more than 100 trace level organics largely attributable to household products; b) ten percent of trace level organic loadings by volume may be detected up to 200 feet from the leach field in sandy soils; c) Trace level organics may travel only a few feet in heavy clay soils; d) five classes of trace level organics account for most of the persistent organics. (According to McKay et al. (1985), these contaminants are likely to persist indefinitely once they have entered groundwater.)

In view of these findings, Tomson et al. (1984) recommended that trace level organics be specifically considered in tank siting studies and permitting, that soil type be given strict consideration in siting, and that a rapid lab soil screening technique (such as that currently being developed at Rice University) be used to assess the potential for migration of organics and pathogens from tanks and leachfields.

Microbial Contamination Attributable to ISDS Effluent Leachate

Improperly treated ISDS effluent can create significant health hazards if bacteria, viruses and other pathogens, which may be present in effluent, contaminate groundwaters, saturated surface soils, or other receiving waters. Research indicates that bacteria and viruses are capable of travelling considerable distances, and that transport may be particularly rapid in highly permeable soils. Heufelder (1988) prepared an extensive review of many pertinent issues relating to entrainment of non-point source-related pathogens in groundwater, transport of groundwater-entrained organisms to estuarine areas, and survival of viruses in marine systems. A review of the scientific literature on microbial contamination of soils and groundwater by ISDS was prepared for the ISDS Task Force by J. F. Musselman. Selected material from these reviews is briefly summarized here.

The Task Force review indicates that the character of the unsaturated soil zone beneath the ISDS is critical in determining transport and fate of bacterial and viral pathogens, particularly where groundwater is near the base of the system. A review by Gerba (1985), presented to the Task Force, identified eight factors as influencing the movement of viruses and bacteria in soils: rainfall, pH, soil composition, flow rate, soluble organics content, cations, adsorption characteristics of the viruses and bacteria, and degree of saturation.

Viruses have been found to travel as many as 408 meters horizontally in groundwater from sewage infiltration basins (Keswick and Gerba, 1980), while coliform bacteria have been observed to be transported more than one kilometer in loamy sand aquifers, and several kilometers in karstic aquifers. Soil saturation has been identified as a key factor in transport of viruses by a number of authors.

Heufelder (1988) cited a literature review by Hagedorn (1984) which indicated recorded entrainment of various enteric organisms for distances of 0.6 to 830 m (2 to 2723 ft) and survival times of up to 27 weeks. Hagedorn stated that soil type was the major factor affecting the entrainment distance of enteric organisms. Gerba and Bitton (1984) in Heufelder (1988) cite moisture content, moisture holding capacity, temperature, pH, organic matter content, and competition/antagonism from soil flora as key factors in

determining survival of enteric organisms in subsurface soil systems. Generally, optimum survival conditions occur in moist soils with good moisture-holding capability at low temperatures in more alkaline soils of pH above 5 that are devoid of normal flora (Heufelder, 1988).

Soil adsorption of viruses is governed by a range of physical factors, but adsorption does not immobilize these pathogens, which can be re-released after periods of rainfall to migrate further through the soil. Kreissl (1980) postulated that "contact time" in the unsaturated zone of the soil is the most important removal consideration for pathogens. He stated that direct contact of pathogen-containing effluent with groundwater should be considered synonymous with system failure, as such contact frequently results in long-distance transport of pathogens.

Heufelder found no extant epidemiological evidence specifically linking ISDS practices with disease outbreaks for adjacent recreational water usage, but pointed to much evidence of outbreaks of gastroenteritis and hepatitis involving consumption of contaminated water (e.g., Gerba et al. 1985). McGinness and DeWalle (1983) describe a case report in which an outbreak of typhus occurred among all members of a family whose private well was located over 400 meters from the ISDS of a neighbor infected with the disease.

Movement of Nitrogen and Phosphorus from ISDS

Factors affecting movement of nitrogen from ISDS include degree of soil adsorption, uptake by plants, ammonia volatilization, and denitrification. These processes, are not promoted by conventional ISDS design, and subsequent nitrate-N movement has been widely documented. Because background nitrate levels in undeveloped areas are typically under 100 parts per billion, nitrate inputs can induce eutrophication at levels far below those sufficient to represent a public health concern. Nitrate levels in drinking water are regulated by EPA, which has established a 10 mg/l standard to safeguard infants from methemoglobinemia.

Nutrient loading due to migration of ISDS effluent has contributed to eutrophication in Rhode Island coastal ponds and estuaries where nitrogen has been identified as the limiting nutrient, as in most coastal waters (Redfield, 1934; Ryther and Dunstan, 1971). In these areas, eutrophication may readily be induced by the cumulative effects of fertilizer and ISDS inputs in addition to those of domestic animals and natural sources, such as rainfall and soil organic matter. Nixon (1982) found ISDS effluent to be a very significant source, contributing an estimated 12 to 44 percent of the annual nitrogen load to the eight south shore coastal ponds.

A background document on nutrient movement from ISDS prepared by L. Joubert for the ISDS Task Force Final Report (1987) summarized the results of recent scientific findings. Key points are outlined here:

Preul (1966) found that nitrate can move freely with percolating effluent to groundwater, posing a "serious threat" in coarse textured soils, with dilution alone acting to reduce concentrations further from the source. Other authors have also concluded that denitrification is extremely limited in many soil conditions, and that nitrates encountering an impervious layer beneath the leachfield move in solution without significant further alteration (Reneau, 1977; Walker et al., 1973). Nitrate can migrate significant distances. Ellis and Childs (1973) documented migration distances of 330 feet.

Nitrogen concentrations in ISDS effluent depend upon level of use, but concentrations average 63 mg/l, ranging from 30 to 80 mg/l (Tilchin et al., 1978; Andreoli et al., 1979; Harkin et al., 1979; EPA, 1980). Because natural background levels of nitrate are quite low (below 100 ppb in undeveloped areas), levels of no more than 0.3 mg/l total soluble nitrogen have been found sufficient to induce eutrophication (Viets and Hageman, 1971). Other authors have recommended a nitrogen criterion of 0.10 as necessary to limit eutrophication in pristine waters (Briggs and Feiffer, 1986). Samples of Rhode Island river waters have yielded nitrate levels ranging from 0.30 mg/l on the Branch River, Forestdale to 1.1 mg/l on the Blackstone at Manville.

A similar literature review addressing phosphorus migration (Joubert, 1987) indicated that under most conditions phosphorus tends to be attenuated quickly and efficiently by soil processes. Except in sensitive waterbodies (including fresh waters and some fresher inshore sectors of estuaries), phosphorus presents less hazard as a transportable nutrient than does nitrate. In sensitive phosphorus-limited waterbodies, however, extremely low phosphorus concentrations can induce eutrophication, and very serious concern is warranted.

Although drinking water criteria have not been developed for phosphorus, which is not normally considered a public health threat, limits have been established for control of eutrophication and protection of aquatic life. EPA proposed phosphorus criteria of 0.05 mg/l for mouths of streams entering lakes or reservoirs, and set a 0.025 mg/l within impoundments to control eutrophication (Briggs and Feiffer, 1986). A 1976 aquatic life protection criterion of 0.1 mg/l was established by CEQ, although concentrations as low as 0.01 mg/l have been found to promote eutrophication of open fresh waters (Fetter, 1980).

Ironically, anaerobic conditions in septic tanks convert organic phosphorus and phosphate (which enter ISDS from human waste and detergent sources in equal proportions) to orthophosphate, the form most available for plant uptake (Magdoff et al., 1974). Attenuation of phosphorus in soil is high, but not unlimited, efficiency being based on soil and effluent characteristics. Continued loading can lead to "saturation" of a soil and eventual failure with respect to effluent renovation (Novak and Adriano, 1975). In sandy soils with very fast percolation rates, Sikora and Corey (1976) calculated that soil phosphorus saturation under septic tanks should occur to a depth of 3.41 feet in one year. In contrast, penetration in a slow percolation rate silt loam could be as shallow as 6 inches, according to the same authors.

In general, Sikora and Corey concluded that phosphorus contamination of groundwater could be anticipated primarily in sandy soils with low organic matter content, soils having high water table, and shallow soils over creviced bedrock. Systems in sandy soils near surface water bodies, therefore, are most likely to contribute phosphorus loading to receiving waters. Evidence of contamination would appear after a period of operation, when the capacity of the soil to adsorb phosphorus had been reached. These factors illustrate the importance of setting buffer distances which adequately account for long-term nutrient transport.

Joubert's review of the literature suggested that, in summary, phosphorus removal from ISDS effluent is most efficient in fine textured soils having slow percolation rates and sufficient surface area for cation exchange. Retention capability in coarse textured soils and under saturated conditions would be reduced (Joubert, 1987).

RESOURCE CONTAMINATION: ISSUES OF CONCERN IN THE BAY WATERSHED AND ELSEWHERE IN THE STATE OF RHODE ISLAND

Data on the extent of existing ISDS contamination of water resources in the Bay watershed generally is extremely poor. A DEM one-time sampling survey of private wells near possible pollution sources was completed in September 1987, but concentrated on zones surrounding hazardous waste sites. Of the 450 wells sampled, only three or four were in areas of high ISDS concentration. Final results of the sampling program are not yet available, but occurrence of organics due to ISDS contamination was reported to the ISDS Task Force. Otherwise DEM groundwater sampling efforts are primarily limited to response to hazard incidence, and reported incidents generally reflect contamination due to hazardous waste sources, rather than ISDS concerns.

DEM samples coastal waters for total and fecal coliform in regulating shellfish bed closures. Coliform limits are defined in state Water Quality Standards. The 1988 305(b) Report identifies areas closed for all or part of the year, and known or suspected contaminant sources.

The Department of Health (DOH) samples conventional pollutant levels in public water supply wells pursuant to the requirements of the Safe Drinking Water Act, and may additionally sample reservoirs and private well supplies in response to complaints. Since 1970, fecal coliform concentrations have been used as the indicator of sewage contamination in determining whether water is safe for consumption, shellfish harvesting, and/or swimming.

The Rhode Island Areawide Water Quality Management Plan, river basin plans prepared for Bay sub-basins during the 1970's, and regional water resource management plans all identified general areas of concern, based on extent of sewerage, known soil limitations, and development density. Shallow depth to water table, shallow soil depths to bedrock, and limiting soil conditions were identified as having contributed to severe ISDS contamination problems in many towns, notably North and South Kingstown, Narragansett, East Greenwich, West Warwick, Tiverton, Bristol, Warren, the Aquidneck Island communities, Jamestown, and several communities in the Blackstone and other tributary river basins. These planning sources provide general guidance regarding potential problem areas, but require updating to ensure reliability.

Localized surveys have been conducted in response to evident resource degradation. In the Narrow River watershed, for example, a survey of densely developed areas was conducted by the Narrow River Task Force in 1986 to identify the status of ISDS conditions in areas considered to have been developed beyond carrying capacity. The survey revealed that between 1980 and 1985, existing systems within the three-town watershed experienced a 65 percent failure rate. The towns obtained Coastal Community Impact funds to contract for follow-on study of the severe ISDS problems in the Middlebridge community in South Kingstown. That research revealed that the conversion to public water due to health concerns had actually exacerbated the ISDS overflow problem by raising the water table significantly.

Research conducted in the coastal ponds watersheds, which have soil characteristics similar to that of the Bay's western shore, has directly linked bacterial contamination and nutrient enrichment in the ponds to ISDS contamination of groundwater. Although other

existing and potential sources of contamination have been found, the visible ISDS problems formed the basis for significant policy change in the towns, and spurred development of a Special Area Management plan for the Salt Pond region.

Given present inputs of sewage-related pollutants to the Bay proper from waste water treatment facilities and CSOs, the loadings attributable to ISDS cannot be identified. Nevertheless, watershed and baseflow loadings may be significant, and are considered to be of key importance in themselves in the context of the Narragansett Bay Project. Therefore, Bay basin areas of clear current or potential concern must be considered in this planning analysis.

Important sections of the Bay watershed are characterized by upland till soils with severe limitations for ISDS due to steep slopes, slow permeability, seasonal high water table and shallow depth to impermeable layer. Impermeable soils with perched, seasonal high water table or impermeable layer or layers are susceptible to ISDS failure through: a) effluent surfacing and overland flow to water bodies; b) inadequate unsaturated separation distance to limiting layers, resulting in movement of nutrients and biological pathogens through groundwater, lateral movement along fragipan layer, or channeling through bedrock crevices.

Along the western shoreline of Narragansett Bay, as well as in the coastal ponds watershed, soils are predominantly coarse textured glacial outwash, characterized by excessively rapid permeability. Upland till soils also associated with these areas may be stony and excessively permeable, or may exhibit shallow high water table. Coastal sands are characterized by fluctuating high water table and have severe flooding potential.

Many areas of the Bay watershed experience ISDS overflows, and show evidence of groundwater and well contamination. Bacterial contamination linked to ISDS effluent has forced closure of shellfish beds in the Salt Ponds, and may be contributing to loss of shellfish resources in shallow, semi-enclosed Bay estuaries which are incompletely flushed.

GENERAL FINDINGS

Fundamental Issues

In general, Rhode Island's ISDS regulations as written provide satisfactory guidance to ensure proper functioning of ISDS systems. However, a number of fundamental problems limit the effectiveness of the regulations in addressing impacts of the systems on resource areas. In addition, institutional and political issues affect the involved agencies' flexibility in moving to address broader impact-related concerns.

Secondly, in spite of a wealth of available documentation regarding the costs of sprawl and the need to channel growth into areas where waste disposal can be made effective and safe, development in the Bay basin continues to proceed in a manner which largely ignores the pervasive impacts which improperly treated sewage effluent can create across property lines and jurisdictional boundaries, the costs and benefits which both ISDS and community sewers present, and other issues of concern.

Data Availability

Data on the land, soil, and water resources of the state is inconsistent and requires updating. Although progress is being made in improving the quality of data available for decision making in critical areas, and in the Scituate reservoir in particular, development of an accurate resource data base should be considered a very high priority for the entire state.

Data on the condition of systems, reasons for failure, and the effects of malfunctioning systems on groundwater, water supplies, and habitats is rudimentary. A comprehensive data tracking system must be developed in order to facilitate regulatory enforcement and to enable decision makers at the state, regional and local levels to target efforts effectively, assess results of model programs, learn the strengths and weaknesses of various approaches, and balance priorities among the range of non-point source pollution problems requiring attention.

Program Structure and Function

Although "critical areas" are specifically referenced in the language of the ISDS regulations as requiring special attention, neither the areas nor the procedures are defined. Only public water supply reservoirs are currently accorded special provisions. As presently implemented, the ISDS regulatory program is not effective in protecting water supplies, other critical receiving waters, or coastal watersheds.

In critical areas in particular, DEM must take the lead in strengthening ISDS regulations, because most towns have not moved beyond the state requirements despite their authority to do so. Reluctance is due to lack of technical expertise and staff support and to political pressure.

The regulatory revisions proposed by the ISDS Task Force, which represent a vigorous attempt to address current problems, still would consider only the current status of critical areas, and would not adequately address potential effects of systems on areas which may become important public water supply sources, private well recharge areas, or key habitat resources in the future. As such, even the proposed Task Force regulations would allow certain areas of the Bay watershed to remain vulnerable.

The current regulatory system is strongly dependent on the use of percolation tests to determine site suitability, and relies heavily on the accuracy of information provided to the state by engineers and designers insufficiently trained to make adequate hydrogeological assessments of site parameters. As such, it is vulnerable to potential data inadequacy or inaccuracy, and to misinformation.

Current evaluation methods and regulatory requirements are unable to deal adequately with cumulative effects of ISDS sitings, particularly where large systems, or multiple systems serving subdivisions are concerned. Similarly, DEM policy on the development of package treatment plants in areas of multiple ISDS failure is insufficiently clear.

Communication among DEM sections concerned with ISDS within the Division of Groundwater and Freshwater Wetlands, and among decision-makers at DEM, the Division of Planning, and CRMC is incomplete. This is due in part to staffing limitations, in part to the overlapping sequences of procedures surrounding review of permits and variances, and in part to differences in technical training and inconsistencies in interpretation of mandate. There is a clear need to establish better coordination and consistency of approach among these groups, through formal and informal means.

There is a clear need for improved coordination between point source and non-point source control programs at DEM, particularly where wastewater treatment issues concerning package plants and septage disposal are concerned. The Office of Environmental Coordination should take the lead in improving coordination.

In all of the agencies concerned with ISDS-related permitting (in fact, in all of the state's permitting programs), staff limitations and the burden of permit review create a focus on achieving efficient permit decision-making to the exclusion of broader program development, strategic planning, program coordination, or review of cumulative effects.

CRMC, through the Coastal Resources Management Program and particularly through the implementation of Special Area Management Plans, possesses broad authority to regulate ISDS siting in view of the potential impact of these systems on the coastal environment. CRMC authority complements that of DEM's Division of Wetlands and Groundwater, which issues ISDS permits to ensure that minimum standards are upheld with respect to the siting, design, and construction of the systems.

While ISDS Task Force Recommendations, and the recommendations of this study, attempt to broaden the consideration of groundwater impacts in DEM ISDS permitting, current regulations are oriented toward system function and relate primarily to public health considerations. For these reasons, effective interpretation and implementation of CRMC's strong coastal resource protection mandate is of key importance. As described in related sections, CRMC has interpreted its jurisdiction narrowly and has been unable to enforce many of its policies and permit requirements.

Concerns at the Local Level

The present regulatory system relies on town building inspectors to ensure adequacy of system sizing, and to assume the primary inspection role. Almost without exception, building inspectors have neither the time, the training, nor the political independence to perform this task adequately. Further, inspectors have no presumed authority to notify DEM of instances of violation.

In general, planning capability at the local level is woefully inadequate. Although some towns have moved to develop qualified local planning staff within the past several years, many rural communities in the Bay watershed, where ISDS problems are most severe, have no planning staff at all, let alone the planning capability to address difficult wastewater management issues. Research in other Bay Project watersheds shows that local planning capability is strongly correlated with development of effective non-point source control programs.

Even in towns having planning resources, implementation of comprehensive wastewater management programs has been uneven. While some municipalities have developed successful programs, others have established costly and unfortunate sewerage precedents in low density areas, or have used sewerage to attract development at high cost to the general public.

It is extremely important that towns make clear commitments to sound planning and sound wastewater management, using verifiable water quality data to support decision making. Wastewater Management Plans should be prepared as an integral part of the Comprehensive Planning process, and should clearly identify degraded areas to be sewerage, and timing of sewer extensions to be made into other resource areas. In areas unsuited to use of ISDS, lot sizing or other land management controls should be used to ensure adequate treatment capacity for effluent.

The technical planning capability and expertise of the Division of Planning is insufficiently utilized by local governments and other state agencies. Technical input from the Division is given insufficient weight in permitting decisions by DEM and CRMC. Division personnel, conversely, do not feel that they are in a position to gainsay regulatory agency decisions.

Special Issues Concerning Regulatory Authority

Within the past few years, court decisions and appeals reversals have contributed to an atmosphere of great regulatory caution with regard to the legitimate use of local police power to protect public health and welfare, and to the use of state regulatory authority as it affects land use. As a result, limited state zoning enabling legislation has been interpreted as placing more severe restrictions on exercise of local police power than it actually may. (See Appendix I on the use of local regulatory authority.

A major educational outreach campaign from the State Attorney General's Office is needed in order to dispel undue fears of inverse condemnation suits among permit granting agencies at the local and state levels. Currently, such fears are routinely affecting decision-making.

The regulatory appeal procedure applied in Rhode Island creates a presumption that the burden of proof should fall to a regulatory agency to demonstrate that enforcement of regulations would not do manifest injustice to a permit applicant. The appeal procedure is cumbersome and gives excessive power to the judiciary in interpreting technical regulatory mandates of executive agencies. The appeal procedure should be limited by strict criteria of entry. The criteria should ensure that the burden of proof falls to the applicant to demonstrate that the same degree of environmental protection could be achieved without strict application of the provisions from which relief is sought.

SPECIFIC PROGRAM FINDINGS AND CONCERNS

The following sections outline specific program strengths and limitations identified during the course of the present research investigation. Findings and concerns are presented, and recommendations are made as to potential regulatory or administrative

means by which to resolve issues, fortify regulatory language, or update program approach. Recommendations which coincide with those of the ISDS Task Force are presented in italics.

TRAINING AND LICENSING

Findings and Concerns

Because severe health and environmental hazards may result from installation of ISDS designed and sized on the basis of incomplete or inadequate site evaluation, the importance of the site evaluation process, and its interpretation, cannot be overemphasized.

Many engineers, contractors, surveyors, drain-layers, sanitarians, ISDS installers, waste haulers, building inspectors, and other town and state officials, as well as the public clients they serve, are insufficiently informed regarding the purpose of site evaluation, and the critical roles which proper design, installation, and maintenance of ISDS play in preserving the consumer's investment, protecting public health and preventing water quality degradation.

Although DEM currently licenses ISDS installers and waste haulers in accordance with DOH standards, existing licensing procedures are out of date and were designed to address limited health-related concerns rather than complex joint issues of water quality and public health. Septage haulers are presently required to submit manifests under the state hazardous waste law, but the provision has not been enforced by the Division of Air and Hazardous Materials.

Recommendations to RIDEM

***A training handbook describing principles of ISDS function, potential water quality impacts, and the basics of ISDS protection and maintenance should be prepared.** The handbook should be distributed to all applicants for ISDS permits, to towns for distribution to homeowners, and to the general public. Save the Bay, Inc. has published a useful pamphlet of this nature.

***A technical training manual should be prepared for DEM staff, designers, installers, contracting professionals, building inspectors, and state and town officials.** The handbook should describe the basis and rationale of site evaluation, the principles of ISDS function, issues of concern in installation and maintenance, and potential water quality impacts of failed systems.

*****Develop a mandatory licensing and certification program for all professionals associated with ISDS design, siting, installation, inspection, and maintenance, including performance of percolation tests.** Program staff, engineers, registered surveyors, sanitarians, licensed drain-layers, installers, building inspectors, plumbing inspectors, haulers, and all other associated professionals should be required to complete a classroom training course, pass a written exam, and pass a field exam which would demonstrate the qualifications necessary in responsibly dealing with these systems. Consider requiring confirmation certification for professionals having grandfathered rights. For training of private sector professionals, training program costs should be supported by professional associations, and by license fees. For training of state and local program staff, costs should be allocated among the state and towns.

****A policy evaluation manual describing waste water management issues should be prepared for town and state officials and the Rhode Island courts, as a companion to similar volumes addressing other non-point source pollution problems. The publication should reference available documentation regarding the costs of sprawl and the need to channel growth into sewer areas or areas where soils can accommodate properly installed and maintained ISDS effectively and safely. The handbook should address the need for protection of water supply aquifers and other natural resources, the pervasive impacts which improperly treated sewage effluent can create across property lines and jurisdictional boundaries, the costs and benefits which both ISDS and community sewers present, and other issues of concern.**

CRITICAL AREAS

Findings and Concerns

Delineation

Given the severe limitations which many watershed soils present with respect to effluent disposal, provision of adequate buffer distance and groundwater separation becomes critical in providing a margin of safety for receiving waters. Nitrates, in particular, are capable of moving beyond any buffer distance under highly permeable or saturated conditions. Other nutrients and pathogens are attenuated by transport through a buffer zone, albeit less effectively in highly permeable soils, or under saturated conditions.

Current ISDS site suitability evaluation procedures and policies governing the issuance of variances are unable to address these concerns effectively. Water table separation requirements provide a key example. Areas where the water table is 0 to 24 inches below the ground surface are considered unsuited to ISDS construction. However, applicants are generally allowed by variance to construct ISDS in areas where the water table is at 2 feet below ground level, even where soil suitability is marginal or unsatisfactory and effluent contaminants may leach directly into groundwater.

In the Scituate Watershed, 60 percent of the land area falls into SCS soil group categories associated with water table levels at 18 to 36 inches below ground level. Variances now being issued in this rapidly developing area may seriously compromise water quality in the Scituate Reservoir, which serves 60 percent of the state's population.

In areas where the water table lies between two 2 and 4 feet below ground level, groundwater effects depend on soil and saturation factors, while effects on surface receiving waters depend on density of development and buffer size. To address these interrelated factors, the present research effort proposes a two-tiered sensitive area definition, identifying Sensitive Areas on the basis of soil characteristics and potential water supply resource availability, and Critical Areas on the basis of (in addition to these factors) current water supply utilization, and location in geographic zones influencing coastal resources. (The ISDS Task Force did not designate all public water supply watersheds as critical areas, but instead focused its designation on the Scituate Reservoir due to its importance and severe soil vulnerability. The Task Force noted the possibility that other water supply watershed areas should be considered for future critical area inclusion.)

The two-tiered definition is based upon the precept that escalating development occurring and anticipated in the state demands that all soils presenting constraints to ISDS development (in the natural state of the soil strata prior to draining, excavation, or other alteration) must be considered as presenting potential risk to future water supply development and/or potential health hazard risk.

Sensitive areas are considered to include:

- groundwater recharge zones of municipal water supplies
- coastal watersheds (Coastal Ponds watersheds and watersheds of poorly flushed embayments are considered Critical Areas)
- surface water supply watersheds
- Wood/Pawcatuck River Watershed.

Sensitive Area soils include:

- upland till soils characterized by:
 - steep slopes
 - slow permeability
 - seasonal high water table
 - shallow depth to impermeable layer (hardpan)
 - excessively rapid permeabilities
- glacial outwash soils characterized by:
 - excessively rapid permeabilities
- coastal sands characterized by:
 - excessively rapid permeabilities
 - high water table
 - flooding potential

(others as denoted by the USDA Soil Conservation Service)

Specific soil families include Paxton, Woodbridge, Ridgebury, Whitman, Leicester, Canton-Charlton, Sutton, Hinckley, Agawam, Enfield, Bridgehampton, Merrimac, Matunick, Gloucester, and Wapping.

Recommendations to the Department of Environmental Management

******Develop specific ISDS siting, design and maintenance standards for use in areas where effluent may potentially impact surface water supplies, sensitive water bodies, and/or other critical areas in such a way as to hinder attainment of water quality and use goals. Revise ISDS standards to include full descriptions of standards to be applied in these areas.***

*****Revise ISDS regulatory language to state specifically that RIDEM regulations establish minimum standards and that more stringent standards for ISDS siting may be adopted by local governments for protection of critical areas. Describe***

methods by which state procedures will be referenced to ensure consistency with more stringent local standards. Describe methods, by which such standards will be enforced by DEM, or referred to towns for enforcement. (Again, this recommendation is based on the assumption that DEM must take vigorous action in strengthening regulatory program capability and enforcement, particularly in critical areas.)

Buffers, Setback Requirements, Separation Distances

Time of travel of ISDS effluent through unsaturated soil must be sufficient to provide treatment to remove microbial organisms, phosphorus and nitrates to the greatest extent possible. Systems must be constructed so as to function properly without failure via surface breakout or discharge of improperly treated effluent to groundwaters. In the event of system failure, opportunity for effluent renovation must be provided via natural or induced degradation before effluent may be allowed to discharge to surface waters. For these reasons, provision of adequate buffers and separation distances is of great importance.

Recommendations: Critical Areas Identified by the ISDS Task Force and by the Present Study

Water Supply Watersheds

(Note: The Task Force designated only the Scituate Reservoir Watershed as a Critical Area; this study applies these recommendations, in addition, to water supply watershed Sensitive Areas, to be evaluated in consideration of cumulative non-point source inputs. Here, recommendations are repeated for all critical area classifications to indicate distinctions between Task Force recommendations and those of this study.)

Given the necessity of protecting water supplies, increase groundwater separation distance requirement to four feet.

******Increase setback requirement to require that distance between all parts of ISDS and reservoir, tributaries thereto, and open or subsurface drains thereto, be a minimum of 200 feet.*** (This represents an increase of 100 feet over the present setback requirement of 100 feet from drinking water sources.) Require that surface runoff from fill or mound systems be contained within 100 feet of the reservoir.

*****Revise ISDS regulations and variance granting procedures to stipulate that variances for standard system construction will not be granted in areas where the water table is less than 3 feet below ground surface.**

****For large systems or subdivisions (combined flow exceeding 2000 gpd), develop regulatory standards which provide for adequate separation based upon soil conditions, effluent characteristics, and other site specific conditions.** Use of a point-based system such as that described in SITE EVALUATION, below, may be applied to establish thresholds guiding the level of technical evaluation necessary to establish design and siting requirements.

****Adopt cumulative impact assessment procedures based upon contaminant loading to consider potential impacts of a) new systems in areas developed beyond carrying capacity; b) large systems and subdivisions in sensitive areas, soil-limited areas,**

or areas of potential water supply where combined flow exceeds 2000 gpd; c) large systems and subdivisions in all other areas where potential waste flow exceeds 5000 gpd. (Dr. D. Urish, associated with the U.R.I. Civil Engineering Department, is currently developing cumulative impact assessment procedures under contract to DEM.) A formula-based system has been applied successfully in Falmouth, Massachusetts. Connecticut and New Hampshire both use loadings formulas to determine lot size requirements.

Use existing basin plans to identify areas where cumulative impacts represent a current or future concern.

Coastal Areas

(Note: The Task Force designated only the Coastal Ponds as Critical Areas)

****** Increase setback from 50 feet to establish 150 foot setback from all parts of ISDS to poorly flushed coastal waterbodies, or their tributaries, requiring applicants to acquire leach area easements as necessary.***

******Establish 100 foot setback from all parts of ISDS to coastal features, and other coastal waterbodies, or their tributaries.***

******Due to frequent presence of excessively permeable outwash soils (percolation rate exceeding 5 min/inch), establish four foot groundwater separation requirement. Require five foot depth to the natural water table from original ground surface.***

******Revise ISDS regulations and variance granting procedures to stipulate that variances for standard system construction will not be granted in areas where the water table is less than 3 feet below ground surface.***

*****For large systems or subdivisions (combined flow exceeding 2000 gpd), develop regulatory standards which provide for adequate separation based upon soil conditions, effluent characteristics, and other site specific conditions. Use of a point-based system such as that described in SITE EVALUATION, below, may be applied to determine the level of technical evaluation necessary to establish design and siting requirements.***

*****Develop cumulative impact assessment procedures based upon contaminant loading to consider potential impacts of a) new systems in areas developed beyond carrying capacity, and b) large systems and subdivisions where combined flow exceeds 2000 gpd.***

Groundwater Recharge Zones of Municipal Water Supplies

Designate as Critical Areas all groundwater reservoirs currently or potentially suitable for public water supply (as defined by the R.I. Water Resources Board) and their recharge areas (as defined by USGS and/or DEM Division of Water Resources).

Revise ISDS regulations to:

*****Establish minimum buffers of at least 400 feet from ISDS to all public wells serving 25 or more persons for six months per year or longer, an increase of 200 feet above current requirements.**

*****Revise ISDS regulations and variance granting procedures to stipulate that variances for standard system construction will not be granted in areas where the water table is less than 3 feet below ground surface.**

****For large systems or subdivisions (combined flow exceeding 2000 gpd), develop regulatory standards which provide for adequate separation based upon soil conditions, effluent characteristics, and other site specific conditions. Increase buffers where total flows exceed 2000 gpd, and where high intensity residential, commercial, or industrial use is anticipated. Establish maximum loading of 2000 gallons/day/acre under specified conditions. Use of a point-based system such as that described in SITE EVALUATION, below, may be applied to determine the level of technical evaluation necessary to establish design and siting requirements.**

****Develop cumulative impact assessment procedures based upon contaminant loading to consider potential impacts of a) new systems in areas developed beyond carrying capacity, and b) large systems and subdivisions where combined flow exceeds 2000 gpd.**

Individual Wells

Revise ISDS regulations to:

*****Increase setbacks from all parts of ISDS from 100 feet to 150 feet where soils are excessively permeable (percolation rate exceeding 5 min/inch) and where fractured rock occurs.**

****Establish four foot groundwater separation in excessively permeable soils (percolation rate exceeding 5 min/inch). Require five foot depth to the natural water table from original ground surface.**

****Require five foot separation distance from the bottom of the leach field to fractured bedrock (equivalent to six feet from the original ground surface to protect against channeling of effluent).**

****Develop cumulative impact assessment procedures based upon contaminant loading to consider potential impacts of a) new systems in areas developed beyond carrying capacity, and b) large systems and subdivisions where combined flow exceeds 2000 gpd.**

SITE EVALUATION

Findings and Concerns

Although the simplicity and convenience of the percolation test have made it the most commonly used technique for evaluating site suitability, a number of flaws limit its reliability in application to ISDS siting:

- Results may vary by 90% or more in the same soils (US EPA, 1980);
- The test is not capable of measuring any fundamental soil properties, such as hydraulic conductivity, which are of key importance in predicting potential system failure.
- The percolation test cannot be reliably reproduced (Bauma et al., 1972);
- Limiting use of percolation tests to certain seasons fails to capture long term trends in water table variability;
- "Dosing" of a site prior to the performance of a percolation test can produce misleading results; and
- Test accuracy may be vulnerable to drainage alterations which have previously affected the site.

In view of the percolation's unreliability, RI ISDS regulations require that soil test pits be dug and examined by licensed engineers, and that descriptions of soil layers, ground water separation, occurrence of impervious layers and other pertinent information be evaluated as part of the permit evaluation. ISDS staff "observance" of the soil trench examination is required.

In practice, the ISDS Section is insufficiently staffed to observe soil pit examinations consistently, except in known problem areas. Therefore, the staff must frequently rely on percolation results, and the reports of contract engineers who are generally not trained in soil science to the degree necessary in order to evaluate many site parameters indicative of potential concerns. Additional staff engineers, soil scientists, hydrogeologists, and system designers are critically needed.

Certain key aspects of soil drainage can contribute to system failure and/or resource degradation. For example, groundwater mounding frequently occurs in "tight" soils, while very fast percolation through coarse soils may cause rapid development of a biological "mat" which inhibits leachfield permeability.

The soil pit analyses required by the regulations, even where performed, are not capable of fully evaluating the potential for failure introduced by system design under specific hydrological conditions. Where permitted designs rely on percolation tests, potential overloading of natural soil capabilities becomes virtually impossible to evaluate.

Recommendations

A. Site Evaluation Procedure

*****Re-examine site evaluation procedures, in light of best available research results. Begin process of converting to comprehensive soil evaluation (currently used successfully in several New England states) as site evaluation method.***

******Require two sufficiently spaced percolation tests on all sites where percolation results are utilized in the site evaluation, and use the percolation test only in combination with other soil tests showing soil profile characteristics accurately.***

******Require full soil examination where percolation rates are excessively fast or slow, or where depth to water table or impervious layer is less than 4' and 6' respectively. Establish minimum design rate on rapid percolation rate soils to ensure that a system is large enough to accommodate slower infiltration following natural formation of a biological "mat."***

****Require that mounding analysis be performed by a certified engineer where ISDS flow rates exceed 5000 gpd.***

****Require submission of the newest applicable RI Soils Survey map with all ISDS permit applications. The soils survey data is currently being recompiled by the SCS to improve photogrammetric accuracy. In that regard, the data will become increasingly useful in improving the accuracy of site suitability evaluation and sizing, in tracking system performance and failure, in relating performance to soil characteristics, in targeting ISDS rehabilitation grants to areas of greatest need, and in assisting towns in addressing sewerage requirements.***

B. Site Suitability Formula

****With the assistance of the URI Department of Engineering and Natural Resource Sciences, develop a point system for site suitability analysis:***

- A clear formula should be specified in the regulatory language as establishing firm numerical criteria to be used in system sizing and design and in establishing variance conditions and inspection schedules. The formula should assign a specified number of points for soil type, depth to groundwater and impervious layer, slope, lot size, buffers to waterbodies, type of development and flows, existing drainage alterations, availability of public water and location of lot with respect to groundwater aquifer, water supply watershed, coastal watershed, or other vulnerable areas.
- Using the point formula, update design flow requirements and siting stipulations to provide adequate system size, establish adequate buffer distances, account for cumulative impacts, and provide for protection of sensitive areas as outlined in other sections of these findings and recommendations. The formula would not provide relief from minimum sizing, separation, and buffer requirements, but would be used to increase predictability of expected requirements.
- Require two percolation tests on all sites where percolations are used.
- *Establish minimum design rate on rapid percolation rate soils to ensure that a system is large enough to accommodate wastewater flow following formation of biological "mat."*

C. Site Evaluators

****Develop a system of licensing private Site Evaluators, such as that employed successfully in Maine since 1974.** Responding to the demonstrated unreliability and inconsistency of percolation tests, Maine instituted a system whereby individuals having college degrees in Soil Science, Geology, or Forestry can apply to operate as Site Evaluators.

In Maine, the Evaluators must pass a three part written examination and a field examination given by the state. Evaluators contract with ISDS permit applicants to perform comprehensive soil evaluations in accordance with Maine's soils-based evaluation criteria, and are licensed to perform examinations for systems with up to 2000 gpd capacity. Licensed engineers must evaluate site suitability for larger systems. Evaluation results are presented to the applicant for use with the point-based permitting system, and copies are forwarded to the town and the state Dept. of Human Services, Division of Health Engineering.

The Department communicates regularly with the Maine Association of Site Evaluators, and considers that the evaluators accurately interpret the state's requirements. Privatizing the most labor-intensive portion of the program allows the state to operate the entire permitting program very efficiently.

D. Staffing

*****Increase staff of ISDS Section or Groundwater Section, or develop joint staffing capability among these two sections and the Freshwater wetlands section to ensure that accurate site evaluation and system sizing decisions can be effectively made,** while providing for a reasonable turn-around time to the applicant. Hiring sufficient soil scientists, hydrogeologists, and engineers will require, at a minimum, tripling the size of the ISDS Section staff, which is presently working overtime under the existing program.

SPECIAL CONSIDERATIONS IN EVALUATION OF DRAINAGE PARAMETERS

Findings and Concerns

In many areas of the Bay watershed where a seasonal high water table occurs, underground drainage devices are used to lower the water table artificially by intercepting groundwater. These subdrains prove effective on sloping areas of seasonal high water levels, and have been applied on a large scale to drain major housing developments in areas of marginal site suitability. Placed upgradient from the proposed leach field site on single lots, they are utilized to obtain permit approval for individual system.

Use of subdrains creates a number of potential hazards:

- a) Partly because the potential effectiveness of the drains is reduced with distance from the drain itself, the potential to intercept improperly treated ISDS effluent is significant, particularly in level areas. Although the unreliable performance of subdrains in level areas has led to use prohibitions in some states, even uphill

drains may intercept ISDS effluent due to groundwater mounding or natural variations in groundwater surface levels.

- b) Given the risk of effluent interception by subdrains, the impacts of drain discharge are of critical importance. Subdrains may discharge any of the range of contaminants contained in ISDS effluent and may also cause erosion and channeling of substrates and banks creating significant water quality degradation.
- c) Potential for failure of subdrains is high, due to clogging of the filter bed, obstruction of the discharge point, and backup of overland flow to receiving waters.

DEM regulations regarding subdrains are insufficiently clear as to permitted method of discharge and required setback to receiving waters. Presently, the 100-foot required buffer from ISDS to public water supplies is defined to include "tributaries, drains and subdrains thereto." Task Force findings state that, in practice, only those drains and subdrains which are directly connected to natural wetlands or tributaries are included in this definition.

Further, manmade stormwater drainage ways and drains which discharge flow overland before reaching reservoir waters are protected by 25-foot, rather than 100-foot buffers.

Although DEM's policy is to prevent direct discharge of subdrains to surface waters, no minimum distance of overland flow is recommended. Unless some effluent treatment is provided by overland flow, the actual buffer distance may consist only of the 25-foot required setback between the subdrain and the ISDS.

Recommendations

****Revise ISDS regulations to establish definitions of tributaries and drains which are based on flow characteristics.** The regulatory definitions applied under the Freshwater Wetlands program provide that "areas subject to storm flowage" include naturally occurring intermittent streams connecting wetlands, which may be classified as rivers requiring 100 foot buffers. **In order to provide consistency with the freshwater wetlands definition, which also addresses manmade stormwater drainageways within the "flowage" definition, the ISDS definition of tributaries and drains should similarly address flow characteristics.** In both programs, the definition of intermittent streams should be clarified so as to be tied to soil characteristics. (For example, intermittent highly meandering streams are characteristic of Ridgebury soils).

*****Revise ISDS regulations to prohibit use of subdrains in all critical areas as defined in CRITICAL AREAS above.**

****If subdrains are permitted in areas outside of critical areas, adopt the following regulatory standards for ISDS, which expand on those recommended by the ISDS Task Force:**

- a) *The minimum distance from a subsurface drain to any part of a sewage disposal system shall not be less than 25 feet where located uphill of the system and no less than 75 feet on the downhill side. Where pre-existing subdrains occur on lots*

adjacent to new development, a 75-foot setback shall be applied from the subdrain to the new ISDS.

- b) A minimum buffer of 100 feet from the point of subdrain discharge to any surface water body or wetland must be provided. Such buffers must provide adequate effluent treatment via approved mechanisms, including overland flow, infiltration or vegetated channel passage. The design of buffers should also ensure non-erosive passage through the vegetative buffer and proper discharge from it. Buffers must meet applicable requirements of the Freshwater Wetlands Program, CRMC, and local drainage control requirements.
- c) Use of subdrains in level areas is not recommended due to unreliable performance.
- d) *As a component of the ISDS application process, the engineer/installer must demonstrate that the subsurface drain will effectively lower the water table while maintaining the required 25-foot setback from the ISDS and that overland treatment for a minimum of 75 feet will provide effluent renovation without inducing water quality or erosion impacts to receiving waters.*
- e) As a component of the ISDS application process, the engineer/installer and homeowner shall prepare for approval a plan for maintenance of the subdrain buffer area, outlining ownership and maintenance responsibility. When agreed upon, the plan shall become a permit attachment and deed encumbrance, subject to property transfer verification and to inspection by DEM and applicable WWMD.

FILLED SYSTEMS

Findings and Concerns

Where minimum required separation distances to groundwater or impervious surface (four and six feet respectively) cannot be met, current ISDS regulations provide that two and four foot separations may be acceptable if the site is altered via filling or excavation. System designers may fill above the original ground surface to meet separation requirements, or may excavate low permeability material and replace it with more permeable substrate. Variances may be granted to adjust separation distances.

Use of filled systems presents several concerns:

- a) Runoff from filled systems constructed on small lots frequently creates drainage problems on adjacent properties;
- b) Design standards for fill systems inadequately specify requirements for fill material to be used. As a rule, coarse sand or gravel fill is used due to high permeability. Because coarse soils have been found to be much less effective in removing nutrients and microbial pathogens than less permeable soils, these systems can rapidly release improperly treated effluent into groundwater or other receiving waters. The risk of contamination is increased where excavation of natural soil materials within a short distance of the water table creates smearing or compaction of wet soils, severely limiting the soil's capacity to renovate effluent.

- c) Fill systems have exhibited a higher failure rate than conventional systems, due to surface seepage, groundwater mounding, and localized overloading (ISDS Task Force, 1987).

Section SD 15.03 (b) of the ISDS regulations authorizes construction of filled systems in site conditions otherwise not conforming to regulatory requirements, but provides no standards for design or construction of filled systems.

Present inspection procedures, which provide for inspection of the dug pit before installation, and of the top material prior to covering with topsoil, are inadequate to ensure satisfactory installation of properly protective material throughout the fill system.

Recommendations

Revise ISDS regulations to:

*****Prohibit use of filled systems in sensitive areas as defined in CRITICAL AREAS, above, where a) depth to groundwater from original ground surface is less than four feet, except in excessively permeable soils (per rate exceeding 5 min/inch), where five feet is required, and b) where impervious material, including fractured rock, "rotten" rock, or shale is less than six feet from the original ground surface.***

*****For situations where use of filled systems is permitted, establish specific regulatory construction standards to:***

- a) retain surface runoff on site by requiring a ten foot buffer from the edge of a leaching system to any adjacent property line; and*
- b) require that a layer of slowing material be used with gravel fill to ensure that sufficient effluent treatment is achieved. A formula for use of fill material component layers should be prepared, with governing factors provided to the engineer/installer by the Site Evaluator, or licensed evaluation professional.*

MOUND SYSTEMS

Findings and Concerns

In an effort to address the many limitations of filled systems, much engineering research effort has focused on the development of practical designs for raised fill or "mound" systems. The advantages and disadvantages of mound systems, along with other alternative systems, were analyzed in depth by an ISDS Task Force Subcommittee. Mound system construction involves considerable engineering analysis, and systems require careful maintenance, two factors that limit their usefulness. Nevertheless, the Task Force recommended use of mounds as replacement for failed systems in situations where existing development prevents installation of a conventional system. The Task Force specified that proper monitoring of systems installed under these specific conditions should be provided for, and encouraged the development of training courses and materials which could ensure their proper siting, design, and construction.

Recommendations

**Permit use of mounds as replacement systems in critical areas where conventional repair or replacement of failed systems is impracticable. Mounds should not be permitted as an alternative to conventional systems for new housing construction except as specified within strictly controlled pilot programs in key public water supply watershed areas.*

**Prohibit use of mounds where existing depth to groundwater does not exceed two feet or where depth to an impervious layer does not exceed four feet under natural soil conditions.*

***Develop specific design, construction, and maintenance standards for mound systems as outlined in the ISDS Task Force Subcommittee Report on Alternative Systems.*

**Prepare a Rhode Island Siting, Design, and Construction manual for mound systems as outlined in the ISDS Task Force Subcommittee Report on Alternative Systems.*

PACKAGE PLANTS

Findings and Concerns

DEM is presently developing a regulatory strategy to address issues surrounding development of package sewage treatment plants. Although regulatory language is not yet in place, DEM operating policy is to discourage development of package plants in new developments due to monitoring and maintenance problems. Experience in other states indicates that these plants can significantly degrade resources and can concentrate waste at one discharge point where health hazards can result if treatment has been incomplete. In Rhode Island, DEM is under particular pressure to allow construction of package plants to serve subdivisions in rural areas, where monitoring and maintenance problems and establishment of accountability would be most severe.

Major issues raised as a result of experience in other states include:

- maintenance, operational and monitoring problems that are the inherent outcome of the proliferation of small treatment facilities;
- water quality impacts that could result from the failures of such small treatment facilities. Package plants are particularly susceptible to toxic contamination;
- environmental impacts of package plants in marginal areas;
- growth and planning of the use of package treatment plants for new single family residential development in areas previously considered unbuildable;
- financing, ownership, and replacement issues; and
- sludge management and disposal.

Package plants also raise complex regulatory issues. New discharges will have to be regulated under DEM water quality regulations to ensure compliance with water quality standards. Plant compliance with regulatory standards will in turn depend on proper

maintenance, which will be difficult to achieve where plants are owned and operated by homeowners associations or neighborhood cooperatives. Further, new discharges are prohibited in certain areas.

Recommendations

***Develop clear regulatory requirements for package plants, specifying:

- a) clear prohibition of package plant construction based on site suitability criteria, and in subdivisions or other facilities where a permanent condo or maintenance fee cannot be attached by a regulatory authority to meet maintenance requirements;
- b) licensing and bonding requirements for operators;
- c) detailed management and maintenance plans to be required of permit applicants;
- d) detailed financing and performance bonding requirements;
- e) requirements for consistency of plant siting with local zoning, wastewater management plans, or other municipal growth management or infrastructure planning programs;
- f) requirements for special up-front compensation by developer for support of maintenance in areas where soils are considered to be of marginal suitability; and
- g) requirements for comprehensive DEM/CRMC/DOH/Division of Planning impact review of all proposals for installation of package plants.

VARIANCE PROCEDURES

Findings and Concerns

Partially in response to concerns regarding inverse condemnation, variances and special exceptions are currently issued to allow ISDS construction in numerous Bay watershed areas incapable of providing proper effluent treatment.

In some situations, potentially detrimental setback alterations may be made without even applying for approval of a variance from DEM. Under Section 3.05 of the ISDS regulations, reductions in setback distances from wells may be obtained without applying for a variance from DEM, provided DOH approval is obtained. As outlined in other sections, DOH narrowly interprets its jurisdiction over groundwater protection.

No minimum standards or written policies govern approval of variances. The DEM variance review committee must evaluate the effect of the issuance on public interest or public health, considering potential impacts to water quality, recreation, public health, and nuisance factors. The DEM variance review committee is made up of members from DEM, the DOH, and local building inspectors, and does not include outside technical professional reviewers.

Variance-related notification procedures have been an issue of considerable concern for some time. Variance board hearings do not require notification of abutters. Notification of towns, water supply purveyors, other concerned divisions/agencies, and other interested parties has been insufficiently formalized, and inconsistent.

Permit appeal procedures at this time provide that an applicant denied a variance may appeal to a regulatory agency's hearing officer and then to court. Courts are generally not familiar with the technical issues at hand, frequently interpret resource protection authority narrowly, and return the decision back to the state agency, effectively ordering issuance of the permit.

As standards of greater stringency are adopted, it is critical to provide clear guidance as to the circumstances under which variances and special exceptions will be reviewed, granted, or denied, and the conditions to be attached to approval.

Recommendations

*****Revise ISDS regulations and variance granting procedures to stipulate that variances for standard system construction will not be granted in areas where the water table is less than 3 feet below ground surface, particularly in critical areas.**

****Establish a point-based system for review of variances and special exceptions, based upon the system which has been successfully applied in the state of Maine. The system should define:**

- *clear conditions under which variances will not be considered . That is, where a presumption would be made that a defined action would substantially endanger public health and environmental quality;*
- a defensible rating system for use in evaluating variance applications which tracks the point-based system recommended in SITE EVALUATION, above. The formula should assign a specified number of points for a) soil type; b) depth to groundwater and impervious layer; c) slope; d) lot size; e) width of buffers to waterbodies; f) type of development and expected flow volume to be generated; g) existing drainage alterations; h) availability of public water; i) . location of lot with respect to groundwater aquifer, water supply watershed, coastal watershed, or other vulnerable areas. The rating system should provide that sites having optimal conditions for waste disposal other than that from which a variance is sought would be considered more favorably than those sites in which several site conditions are marginal or unfavorable.
- conditions to be attached to variances and special exceptions with regard to inspection schedules, maintenance requirements and responsibility, alteration and/or change of use restrictions to be applied, and conditions under which the variance would be revoked.

***Require that no variance will be granted for new ISDS or enlargement of an existing system which increases capacity to accommodate additional flows except after applicant has notified all abutters by certified mail.**

In addition to recommending a rating system, The ISDS Task Force recommended that specific changes be made in the current variance review procedure. These formed the basis for the following recommended procedural changes, which should apply until a more efficient point-based rating system can be established.

*****Expand the variance advisory board to five regular and three alternate members. In addition to DEM, DOH, and local building inspectors, include professionals with expertise in siting and design of ISDS and understanding of public health/environmental issues. The board should include soil scientists, hydrogeologists, town planners, representatives from CRMC or the DEM Groundwater or Wetlands Sections, or others as appropriate to address the specific concerns at hand.***

*****Forward all requests for variances and special exceptions made to the RIDEM ISDS Section (before action is taken) to the appropriate Town or WWMD authorities so that pertinent data on the system and affected areas can be collected and recorded in the WWMD accounting system, and so that consistency with WWMD and Town policies can be assured if Town policies are more stringent than the minimum state provisions. Forward all requests for variances and special exceptions relating to coastal areas to CRMC so that potential impacts can be evaluated as part of the subcommittee review and Council public hearing process.***

*****Formalize notification procedures for variance board meetings to include written notice to local communities, WWMDs, public water supply authorities, watershed associations, CRMC, and other interested parties. Institute a system whereby formal notification can be requested within affected resource areas. (See also TOWN COUNCILS/WWMDs.)***

****Forward copies of RIDEM actions on variance requests, and conditions attached, to the appropriate Town or WWMD authorities so that data can be effectively recorded in the WWMD accounting system.***

******Clearly place the burden of proof on applicant to demonstrate that approval of a variance will not result in a reduced level of protection of environmental quality or public health than that afforded by strict application of regulatory standards. Further, require that the applicant furnish proof that enforcement of the regulations would do manifest injustice.***

SITING AND DESIGN

Findings and Concerns

Rhode Island minimum design standards provide that a percolation rate slower than 40 min/inch is unsuitable for ISDS siting, and that a percolation rate slower than 20 min/inch is unsuitable for siting of large systems having flows exceeding 2000 gpd. These standards do not adequately address site suitability.

Regulatory standards governing the siting, design and construction of large systems, and multiple systems in concentration, are insufficiently detailed.

Although an alternate leaching area must be designated, no regulatory standards govern alternative leaching area characteristics, or prevent the alternative area from being located in a wetland or other unsuitable area.

Neither the ISDS regulations nor the state building code establish standards for materials to be used in ISDS, for the materials to be used in joining system components, or for use of specific materials under site-specific conditions.

Recommendations to RIDEM

Revise ISDS regulations to:

| *****Reflect system sizing recommendations developed by the ISDS Task Force:**

Clearly define "bedroom" in SD 1.01 (a) as per Task Force recommendations;

*Establish minimum residential design flow based upon 3-bedroom design.
Amend Section 10.01 to require that all systems serving individual dwellings shall be designed to serve a minimum of three bedrooms, unless evidence is submitted that a deed restriction limiting dwelling size to an approved two-bedroom size has been filed with the town's land evidence office.*

| ****Require that local building inspectors confirm sizing compliance prior to issuance of occupancy permit, and forward certification, with results of construction inspection, to applicable WWMD and ISDS section to be included with maintenance/inspection records.**

| ***Definition of "impervious," (SD 1.12: Expand definition of impervious to include "rotten" rock or shale-type fractured bedrock (as distinct from normally fractured bedrock).**

| ***Specify sidewall distance of ten feet from edge of leaching system to impermeable wall.**

| ***Encourage towns to require applicants for new ISDS construction to tie-in to public water supply, where public water supply is reasonably available, to ensure safe drinking supply.**

| ***Update minimum design flow requirements (SD 3.01)**

| ***Impose deed restrictions and/or attach covenant (in addition to disclosure provisions) where recommended design flows are reduced by variance or special exception.**

| ***Eliminate provision for 40 percent reduction in effective leaching area (SD 10.06).**

| ****Establish specific engineering specifications and criteria for materials and construction of ISDS, specifically relating these to site characteristics of concern. Require use of Schedule 40 polyvinyl chloride, steel reinforcement, weighting and stabilization and other specifications as appropriate to ensure against system failure and protect resources and public health.**

SYSTEM FAILURE AND REPAIR

Although ISDS systems properly sited, installed and maintained can provide effective waste disposal, many factors can contribute to system failure, as outlined in other sections. To summarize, causes for failure include:

- inadequate sizing;
- siting in substrate unsuited to installation of ISDS systems;
- use of tanks and D-boxes which are not water-tight;
- faulty installation; insufficient attention to the future integrity and performance of system components;
- insufficient maintenance;
- use of septic tank cleaners; and
- inadequate/improper repair

In many areas of the Bay watershed, and elsewhere in Rhode Island, particularly in the Salt Pond watershed, ISDS failure has led to closure of shellfish beds, contamination of groundwater by nutrients, pathogens, and organic chemicals, and system overflows creating a serious threat to public health. The situation is particularly acute where dense concentrations of systems are located in old neighborhoods on substandard lots and where old inadequate systems designed to support seasonal use are now being relied upon to serve dwellings converted for year-round use. Frequently, the most dense concentrations of these old grandfathered systems are on soils least suited to use of ISDS as a waste disposal alternative.

A key weakness of the enforcement program is the fact that enforcement action can be taken only when a system has already failed, while a definition of "failure" is not specified in the regulatory language. Further, current ISDS regulations provide no criteria for maintenance or repair, although pumping is recommended every three years. The vague regulatory language lessens the ability of the DEM legal staff to efficiently issue administrative penalties, and serves to complicate the effective targeting of Sewer and Water Failure Funds.

Recommendation to RIDEM

******Establish a detailed definition of system failure based both on design and performance criteria:***

Design criteria should address:

- hydraulic failure;
- failure of the designed system to meet projected flow needs;
- failure of the designed system to properly consider site factors affecting system function; and
- failure as defined structurally : (a) contact between groundwater and bottom of system and/or (b) effluent entering the water table without reasonable technical potential for adequate treatment through unsaturated soil.

Performance criteria should address treatment failure and failure of the system to adequately treat waste flows, and should require treatment meeting technological design standards, based on the following considerations:

- Public health and safety considerations of inadequate pathogen removal, nitrate removal, removal of toxic compounds including cleaners and solvents;
- Environmental considerations of:
 - hydrologic modification (e.g., altering the existing water table in such a way that incidence of hydraulic failure increases)
 - contributing to nutrient enrichment and potential eutrophication of receiving waters
 - contributing to bacterial contamination of shellfish
 - contributing to surface water degradation
 - exacerbating impacts of other non-point source concerns

*****Revise ISDS regulations to establish specific criteria outlining system owner's special responsibilities to avert system failure in critical areas, or areas of fundamental environmental concern.** Undertake an accompanying education campaign to advise critical area residents as to resource vulnerability, and notify them of their responsibilities. Such areas should be provided as overlays on town assessors maps and zoning maps, and should be designated in the regulations as Special Inspection Areas coinciding with critical area designations and Wastewater Management Districts as identified. Such areas should include, for example, areas having severe soil limitations for ISDS use, areas of existing ISDS contamination, reservoir recharge areas, coastal areas, SAM plan areas, and all critical areas as defined in previous sections.

*****Revise ISDS regulations to define criteria to be applied as a basis for requiring ISDS maintenance, repair, and replacement.** Guidance should be provided based on system size and existing condition and should specify factors of consideration such as:

- size and condition of system and absorption area
- design suitability based on soil conditions
- frequency of malfunction
- other relevant factors relating to public health, cumulative effects, etc.

****Establish clear standards and specifications which system repairs must meet.** (see also VARIANCES)

****Revise ISDS regulations to require mandatory system upgrades for failed systems.** (Current DEM policy is to require upgrading to the maximum extent possible at the time of failure.) In cooperation with towns, establish interim maintenance and pumping procedures to apply to systems which will be included in WWMDs, if system upgrades are to be provided through the WWMD within one year of regulatory revision. Using funds from the Sewer/Water Supply Failure Fund, and other funds as necessary, provide support for system upgrades, giving first priority to systems in towns which have established WWMDs. In towns having approved wastewater management plans, funding may also be available from the Environmental Trust Fund, used to match federal Construction Grants funding.

****Establish specific standards of inspection for systems issued variances from mandatory upgrade.** For these "conditional" systems, a lien would be placed upon the property stating that the owner assumes responsibility to ensure that continued use of a "conditional" system will not result in or accelerate malfunction through system blockage, surface seepage, or groundwater concentration. (see also VARIANCES)

***Using the point system applied to site evaluation and issuance of variances, establish a maintenance and inspection formula for new systems (including those on pre-existing lots) based on site evaluation, size, design flow, existing conditions, and other relevant factors.** Apply these criteria in issuing the ISDS permit, such that the permit becomes a contract specifying responsibility for maintenance and repair, and defining inspection frequency. In WWMDs, maintenance schedules will be established by the WWMD.

CHANGE OF USE

Findings and Concerns

Many of the areas of the Bay watershed which present most significant ISDS concern are old dense coastal neighborhoods established for seasonal use, in which residences have been converted for year-round occupancy. A large proportion of the waste disposal systems in these areas pre-date state construction standards and are in extremely poor condition or have completely deteriorated. Although these older communities are now considered priority sites for upgrading and replacing ISDS, no specific permit requirements apply to change of use for seasonal conversion or where increased flows are proposed. Town building inspectors may require homeowners to seek DEM approval, but otherwise DEM is not generally notified.

Recommendations

|Revise ISDS regulations to specify that:

****No building shall be converted to year-round use from seasonal use, or use changed unless:** a) the lot in question satisfies all current requirements of the ISDS regulations; or b) an agreement for regular maintenance has been made between a WWMD or a licensed waste hauler and the homeowner, specifying maintenance frequency required; and c) the agreement is consistent with applicable mandatory upgrade provisions (outlined in MAINTENANCE AND REPAIR, above); and d) the agreement is attached as a permanent deed restriction or covenant.

ENFORCEMENT

Findings and Concerns

Investigation and enforcement of ISDS failures is inadequate. Several problems contribute to the situation, including shortage of staff, lack of a computerized on-line permit data management systems, lack of availability of monitoring data, and conflicts regarding shared responsibility between DEM and DOH.

Data on the condition of systems, reasons for failure, and the effects of malfunctioning systems on groundwater, water supplies, and habitats is rudimentary. Although the ISDS Section staff have a sophisticated working knowledge of problem area case histories, and possess a detailed understanding of the program's strengths and needs, all recordkeeping is done on paper, and is readily retrievable only when files have been closed and put on tape. Repeated efforts have been made to obtain funding to install an on-line permit data management system which would enable staff to track and cross-reference permit data effectively.

A key weakness of the enforcement program is the fact that enforcement action can be taken only when a system has already failed, while a definition of "failure" is not specified in the regulatory language.

Special Jurisdictional Issues

Currently, responsibility for investigation of overflowing systems is shared between DEM and DOH using an administrative mechanism which is unsatisfactory. The arrangement was established by a memorandum of agreement between the two agencies when DEM was initially created in 1977.

The MOA specified that DOH was to retain responsibility for: a) investigating complaints involving ISDS; b) receiving change of use forms for transmittal to DEM; c) licensing and regulating tank cleaners and installers. DEM would: a) enforce standards for location, design, construction and operation of ISDS; b) certify land for installation of ISDS; and c) enforce regulations adopted by DOH for the disposal of septage.

Although the MOA appeared to outline the agencies' responsibilities clearly, the system has not proven workable, primarily because the initial investigations of overflows are not consistently made in a timely manner. DOH has asserted that it would not be responsible for investigating complaints related to residences and business over which it does not otherwise have jurisdiction. Because those categories constitute 90 percent of complaints, DEM has asserted that manpower and resources for the enforcement program should then be transferred to DEM, where the bulk of investigations would be undertaken.

At present, when an ISDS overflow presents itself as a health hazard because of pooling of effluent on the surface, a complaint may be made to DOH. DOH goes to the site to make a determination, and if the health hazard remains, must notify DEM to enforce the violation of DOH health requirements. Conversely, when DEM identifies a groundwater ISDS violation, it is required to notify DOH and request a DOH determination of violation in order to proceed against the violator. Delays of up to six months have been associated with this process, which, among its other flaws, cannot address changed water level conditions on the site and consequent overflow variations. Thus, if and when a case gets to court, the overflow may no longer be present and the entire enforcement process must be re-initiated.

Fundamental inconsistencies of viewpoint complicate the problem. DEM's jurisdiction relates to general groundwater quality, while DOH is concerned with water quality within the water supply source itself, and with disease hazards presented by surface sewage outflows.

DEM legal counsel asserts that adequate authority exists to enable DEM to require repair of failed system. (Statement by Peter Janaros, Meeting Number Eight of the ISDS Task

Force, Sept. 9, 1986) Mr. Janaros stated that shortage of staff to pursue enforcement through the court system had been the limiting factor, and that a new staff person had recently been dedicated solely to action on major ISDS violations.

As more stringent standards are adopted, instances of violation will undoubtedly increase. DEM must possess sufficient legal staff to pursue ISDS violations of all types with the resources appropriate to a significant public health hazard.

Recommendations to the Department of Administration

****Consolidate ISDS investigation and enforcement responsibilities with DEM, and provide resources adequate to fulfill enforcement responsibilities.**

***Develop a budget process which allocates to the ISDS section a basic annual budgetary allotment, to be augmented by dedication of fees collected by the section.**

Recommendations to RIDEM

*****Increase staff of ISDS Section or related Division Sections to ensure that adequate inspection and enforcement capability exists, and can be dedicated to these purposes.** Hiring sufficient soil scientists, hydrogeologists, and engineers will require, at a minimum, tripling the number of the staff available to undertake inspection and enforcement.

***Increase legal staff devoted to action on ISDS violations.**

****Develop and implement a comprehensive on-line data management system for the ISDS Section, enabling the Section staff to:**

- a) retrieve permit and enforcement data by applicant name plat number, lot number, zoning designation, etc.;
- b) retrieve permit data by site specification (e.g., soil or percolation rate category);
- c) generate educational materials on necessary maintenance to permit holders automatically at appropriate intervals; and
- d) generate enforcement-related documents automatically.

****Develop a comprehensive data tracking system (coordinating the data management system described above with those of the Wetlands and Groundwater Sections and other relevant data management systems at CRMC and the Division of Planning) which would enable decision makers at the state, regional and local levels to target efforts effectively, assess results of model programs, learn the strengths and weaknesses of various approaches, and balance priorities among the range of non-point source pollution problems requiring attention.**

SYSTEM ADDITIVES

Findings and Concerns

As outlined in previous sections, much documented research indicates that the long term damage produced through use of ISDS treatments (including chemicals, yeasts, bacteria, and enzymes) far outweighs any short-term benefit which these substances may provide. Not only is potentially irreversible damage done to the system itself, but the infiltrative capacity of leach field soils may be permanently compromised, and severe chemical contamination of receiving waters may result.

Groundwater testing has revealed chemical contamination likely attributable to ISDS additives in Rhode Island. Despite the current regulatory ban on use of acids in ISDS maintenance except in leaching lines, many pumpers are unaware of the prohibition, and are known to routinely offer clients "the acid treatment" as a component of pumping maintenance.

RIGL Chapter 24.3, entitled "Substances or Compounds Used as Sewerage System Cleaners", presently gives the Director of DEM the authority to designate any sewerage system cleaner as a "restricted material." When a four-step designation process has been completed, and a product has been designated as a restricted chemical, the director has authority to issue orders to persons engaged in the manufacture, distribution, or sale of cleaners, including the recall of these materials. Civil and criminal penalties may be assessed. The availability of this regulatory tool has allowed RIDEM to negotiate alterations in product composition with manufacturers, but no products have thus far been banned.

Recommendations to RIDEM

****Draft legislation for submission to the next session of the General Assembly providing for an across the board ban on the sale of ISDS additives in the state of Rhode Island. Prepare a comprehensive position document on additives, and the hazards presented by their use, expanding upon the findings presented to the ISDS Subcommittee on Regulations.**

*****At a minimum, ban the sale of septic system cleaners in the state which contain organic solvents listed by EPA as potential drinking water contaminants. Use of such products should be prohibited throughout the state, particularly in designated critical areas and areas where groundwater is or may potentially be used as potable water supply.**

****Until a ban on sale of additives can be authorized, establish a system of licensing sale of system additives in the state, using licensing systems applied in other states (e.g., Connecticut) as models. A listing system is needed which places the burden of proof on the manufacturer in demonstrating that a product (or its in-tank generated byproducts) does not and will not degrade groundwater or surface water resources. Such a system would be preferable to the system now in place, which places the onus on the state to prove harm with each individual product.**

*****Prohibit use of septic system cleaners of any type in areas within the recharge zones of sensitive phosphorus-limited waterbodies subject to eutrophication.***

*****Prohibit use of septic system cleaners of any type on substandard lots having insufficient alternative area to install an adequate replacement system.***

EDUCATION

Many engineers, contractors, surveyors, drain-layers, sanitarians, ISDS installers, waste haulers, building inspectors, and other town and state officials, as well as the public clients they serve, are insufficiently informed regarding the purpose of site evaluation, and the critical roles which proper design, installation, and maintenance of ISDS play in preserving the consumer's investment, protecting public health and preventing water quality degradation.

Recommendations

***A policy evaluation manual describing waste water management issues should be prepared for town and state officials and the Rhode Island courts.** The publication should reference available documentation regarding the inter-relationship between growth management and effective watershed management. The handbook should address the need for protection of water supply aquifers and other natural resources, the pervasive impacts which improperly treated sewage effluent can create across property lines and jurisdictional boundaries, the costs and benefits which both ISDS and community sewers present, and other issues of concern.

***A training handbook describing principles of ISDS function, potential water quality impacts, and the basics of ISDS protection and maintenance should be prepared.** The handbook should be distributed to all applicants for ISDS permits, to towns for distribution to homeowners, and to the general public. (Maintenance recommendations currently specified in the CRMP Red Book are itemized in the following section.)

****A technical training manual should be prepared for DEM staff, designers, installers, contracting professionals, building inspectors, and state and town officials .** The handbook should describe the basis and rationale of site evaluation, the principles of ISDS function, issues of concern in installation and maintenance, and potential water quality impacts of failed systems.

OTHER RECOMMENDATIONS

RECOMMENDATIONS TO DEM WETLANDS SECTION

****Require of Applicant:**

- a) copy of most recent available Rhode Island Soil Survey Map identifying all wetlands, floodplains, seasonally flooded areas, and maximum groundwater elevations;
- b) copy of SCS quad sheet identifying all soil locations on site;

- c) copy of USGS quad sheet identifying location of site with respect to water supply watersheds, coastal watersheds, sole source aquifers, or other designated critical areas;
- d) copy of preliminary plan identifying proposed location of ISDS, leachfield footprint, and alternative site, showing required 200 foot separation distance to wetlands; and
- e) copy of preliminary plan identifying proposed location of any subdrains to be installed, if subdrains are permitted in the location at issue.

****Modify freshwater wetlands regulations to ensure that ISDS and wetlands regulations are consistent with respect to required setbacks from wetlands and waterbodies, and that strictest provisions of both programs are applied to one another. Setbacks must ensure that slope and soil conditions of the setback zone, in addition to separation, are considered in establishing a buffer which is adequate to protect wetland resources.**

****A minimum buffer of 100 feet from the point of subdrain discharge to any surface water body or wetland must be provided. Such buffers must provide adequate effluent treatment via approved mechanisms, including overland flow, infiltration or vegetated channel passage. Buffers must meet applicable requirements of revised ISDS regulations, CRMC, and local drainage control requirements, whichever is most stringent.**

*****To the extent possible, process ISDS and wetland permit applications jointly, so that anticipated ISDS location can be evaluated at the time of the initial Wetlands site visit, and/or potential wetlands issues can be noted during an initial ISDS site survey or application review. Applications should be processed with the same reference file number, with duplicate copies of relevant material circulated to Wetlands, ISDS, and Groundwater Sections.**

*****Coordinate with ISDS section to ensure that Freshwater Wetlands section is notified in cases where existence of wetlands requires that applicant obtain a Freshwater Wetland Permit before applying for ISDS approval. Notify all such applicants of the Freshwater Wetlands approval requirement.**

RECOMMENDATIONS TO DEM GROUNDWATER SECTION

*****Work with other DEM sections and outside experts to develop an effective regulatory and management strategy for package plants.**

***Amend appropriate groundwater regulations to support ISDS Task Force recommendations.**

****Develop a comprehensive monitoring program capable of identifying existing and potential problems related to ISDS. In order to channel resources effectively, establish a groundwater monitoring protocol giving monitoring priority to areas having highly vulnerable soil conditions.**

****Based upon the established protocol, determine the degree to which all resource areas are compromised or potentially compromised by ISDS related contaminants.**

****Establish monitoring requirements for owners of ISDS installed in soils of questionable suitability and within critical areas.**

***In the process of developing groundwater classifications, classify and delineate resources so as to support two-tiered definition of critical areas as outlined in Critical Areas, above.**

****Establish numerical standards setting maximum concentration levels for ISDS related contaminants in groundwater. Working with the ISDS Section, establish limits supporting performance criteria for maintenance and repair of failed systems. In developing standards, consider use of a two-tiered system which sets a preventive action limit and an enforcement standard (currently applied in Wisconsin). Both limits would be applied in concert with ISDS permit and tracking mechanisms recommended above.**

***If any ISDS related contaminants of concern are not assigned standards, amend regulations to prohibit discharges which raise groundwater concentrations of such contaminants in the immediate area above background levels (currently applied in Florida).**

***Conduct an economic analysis of groundwater protection alternatives relevant to ISDS to identify geographic priority areas in which to apply protection strategies (e.g., density and siting controls) and correction strategies (e.g., system replacement or sewerage).**

***Develop Aquifer Protection Area Reference Documents and other critical area protection reference documents to assist towns in implementing ISDS management and maintenance programs.**

****In cooperation with the Division of Planning, develop and conduct technical assistance programs to support towns in their efforts to implement ISDS management and maintenance programs.**

***Develop an approach to evaluate land use conflicts within critical water supply watersheds, recharge areas and other critical areas as outlined in previous sections. Develop and propose steps which need to be taken at the state and local levels to resolve land use conflicts which serve to impede attainment of aquifer protection goals.**

RECOMMENDATIONS TO THE DIVISION OF PLANNING

Create a permanent staff attorney position in the Division. The staff attorney would provide objective technical advice to towns regarding zoning, use of moratoria and other land use controls.

****Develop staffing capability to fully address the Division's stated objective to "assist local governments in management, finance, and planning. "Hire new staff whose academic qualifications and experience equip them to provide the technical assistance which towns will require in implementing wastewater management programs and other non-point source control programs.**

*****Expand the Division staff and define responsibilities along technical lines so as to provide a pool of highly qualified planners, that is, a "technical planning pool," which can be available to advise towns regarding**

specific problems, technical and administrative approaches, financing, etc. Identify specific Division personnel as key local government contacts on individual issue areas, including: land use and areas of critical concern; wastewater management; water resource planning; highway planning; housing; management of historical areas; hazardous waste management; and administrative procedures.

****As required by the Local Comprehensive Planning Act of 1988, prepare specific standards and requirements for revision of town comprehensive plans, including requirements for development of regional wastewater facilities plans.**

****Expand staff to ensure that technically qualified individuals from the "technical planning pool" are available to undertake "outreach" activities necessary to ensure successful implementation of the range of wastewater management strategies potentially undertaken by towns.** Outreach will involve regular attendance/participation in meetings of town councils, planning boards, zoning boards, conservation commissions, wastewater management district boards, other town commissions, citizens groups, etc.

RECOMMENDATIONS TO THE COASTAL RESOURCES MANAGEMENT COUNCIL

CRMC, through the Coastal Resources Management Program and particularly through the implementation of Special Area Management Plans, possesses broad authority to regulate ISDS siting in view of the potential impact of these systems on the coastal environment. CRMC authority complements that of DEM's Division of Wetlands and Groundwater, which issues ISDS permits to ensure that minimum standards are upheld with respect to the siting, design, and construction of the systems.

For example, the Narrow River SAM plan contains specific recommendations for ISDS management, citing concurrent pressures from existing ISDS failure concentrations and increasing residential development, particularly in South Kingstown and Narragansett. Advocating that the towns, DEM, the Department of Health, and the CRMC cooperatively formulate a watershed-wide wastewater management plan, the SAM plan outlines actions necessary to address the treatment and disposal problems within the watershed:

- a) Calculate the future reserve and expansion capacity of South Kingstown's Westmoreland Treatment Plant;
- b) Identify and schedule areas that require sewer service, giving priority consideration to areas with concentrations of failed ISDS;
- c) Implement a watershed wide ISDS maintenance program including regular mandatory pumping;
- d) Identify individual failed units; implement a phased replacement program;
- e) Apply Sewerage and Water Supply Failure Fund monies towards these programs;
- f) Develop programs to educate local residents about the use and maintenance of ISDS systems.

CRMC policy on sewer line extensions is outlined in Section 320.2 B, which states that extension to those areas classified as lands developed beyond carrying capacity shall take priority over construction or extension of private, municipal, or industrial sewage facilities or systems, conduits or interceptors elsewhere in the watershed. Priorities are detailed in Section 320.1 C:

Until such time as necessary sewer line extensions can be made to priority areas, CRMC recommends that towns implement a regular maintenance program for ISDS including, at a minimum:

- a) Mandatory pumping every three years;
- b) Appropriation of funds for a maintenance program through the Sewer and Water Supply Failure Fund and municipal bond issues, among other funding sources;
- c) Mandatory reporting of failed or failing systems to town authorities by septic tank pumpers;
- d) Recording of system failure or uncorrected violations of state ISDS regulations on property deeds, as incentive to eliminate chronic ISDS problems;
- e) Development of homeowner education programs and materials on preventive ISDS maintenance, addressing such measures as:
 - water conservation practices;
 - discouragement of garbage disposals;
 - avoidance of disposal of greases and oils into household drains;
 - proper disposal of chemical wastes (paints, thinners, alcohol, acids, drain cleaners, etc.);
 - separate drainfield for washing machine discharges;
 - prohibition of the use of chemical ISDS "rejuvenators";
 - planning for alternate sites in the event of primary site failure; and
 - resting part of the leachfield system periodically through design or installation of alternate beds.

***In accordance with the findings and recommendations included in the ISDS Task Force Report and its Subcommittee Reports, particularly as they relate to coastal critical areas, amend CRMP regulatory language and all SAM plan regulatory language to state clearly:

- a) specific site evaluation criteria to be applied by DEM and CRMC in coastal areas in consideration of potential impacts to sensitive or dynamic coastal systems;
- b) system design, installation, and maintenance requirements to be applied in coastal areas (consistent with the objectives of the point-based system described in previous sections);
- c) procedures to be used in applying a point-based system (such as that described in previous sections) to evaluations of variances and special exceptions;
- d) enforcement mechanisms and penalties to be applied in CRMC actions against violators of CRMC permits; and
- e) CRMC permitting criteria to be applied in implementing a mandatory system upgrade program (MAINTENANCE AND REPAIR above).

****Include all data related to applications for variances from ISDS requirements in subcommittee and Council review of CRMC Category A and Category B development permit requests.**

***Designate a CRMC staff person to provide technical assistance to coastal communities in developing waste water management districts and undertaking regional wastewater management planning. The staff person would work in this effort with Division of Planning staff and with CRMC staff dedicated to SAM plan implementation.**

*****In cooperation with DEM, develop a mandatory licensing and certification program for all professionals associated with ISDS design, siting, installation, inspection, and maintenance. Program staff, engineers, registered surveyors, sanitarians, licensed drain-layers, installers, building inspectors, plumbing inspectors, haulers, and all other associated professionals should be required to complete a classroom training course, pass a written exam, and pass a field exam which would demonstrate the qualifications necessary in responsibly dealing with these systems. Consider requiring confirmation certification for professionals having grandfathered rights. Shared training program costs should be supported by towns, professional associations, and the state, as well as by license fees.**

***A minimum buffer of 100 feet from the point of subdrain discharge to any surface water body or wetland must be provided. Such buffers must provide adequate effluent treatment via approved mechanisms, including overland flow, infiltration or vegetated channel passage. Buffers must meet applicable requirements of the DEM Freshwater Wetlands Program, revised ISDS regulations, and local drainage control requirements, whichever is most stringent.**

RECOMMENDATIONS TO THE DEPARTMENT OF HEALTH OR RIDEM

****Establish a permitting program for installation of private drinking water wells, specifying design, installation, sealing, and maintenance criteria which ensure protection of public health. Establish a regular monitoring and inspection program for private drinking water wells, coordinated with the ambient groundwater monitoring program recommended to the Groundwater Section in other parts of this plan.**

****Establish a training and licensing program for well drillers, requiring that applicants for licenses complete a course run jointly by DOH and DEM, and that applicants complete written and field tests successfully.**

RECOMMENDATIONS TO INDIVIDUAL TOWN COUNCILS

Chapter 45-22 of the General Laws of Rhode Island required cities and towns to establish planning boards or commissions which are required to prepare comprehensive plans. The plans must include, among other requirements, environmental protection programs and a recommended program of action or implementation. Currently, Chapter 45-22 does not require development of wastewater management plans or sewer plans as part of the comprehensive plan.

Although many municipalities prepared sewer plans to comply with federal Construction Grant requirements in the 1970's, several towns in the Bay watershed have more recently recognized the critical importance of comprehensive town-wide wastewater management planning in protecting water quality and ensuring fiscally responsible infrastructure development.

Despite the limitations posed by Rhode Island's conservative zoning enabling legislation, which dates from 1921, several Bay watershed towns have also moved to channel growth toward areas capable of sustaining the impacts of development. Towns have established zoning overlays, resource protection ordinances, and other programs designed to protect public health and welfare.

The following recommendations identify ways in which local initiatives should be expanded:

Inventory

****Undertake an environmental review to determine current and potential hazards presented by present and historical sewage disposal practices in the community.** The review should consider a range of important issues and factors, and should preferably be undertaken so as to support broad planning objectives, including revision of the town Comprehensive Plan, revision of related town ordinances, adjustment of zoning policy, etc. The factors should be assessed quantitatively, and estimates of error should be made where possible. Issues and factors should include, for example:

- growth trends and population projections, by area;
- zoning designations, and variances issued, by area;
- present and future capacity of wastewater treatment facilities;
- present and future capacity of septage waste disposal facilities;
- average and seasonal daily flow projections and capacity limitations;
- levels of flow anticipated from approved projects not yet developed;
- instances of private well contamination, by site;
- location of storm drainage facilities;
- flood plain areas, with flood zone designation;
- wetland areas and their zones of hydrological influence;
- surface water areas/proximity;
- coastal buffer zone areas/proximity;
- areas serviced by sewers or designated for sewer extension;
- areas serviced by ISDS and requiring ISDS failure evaluation;
- areas serviced by subdrains; and
- areas presenting natural limitations to use of ISDS systems because of topography, soil type, depth to impermeable layer, high water table, existing water quality degradation, or other site characteristics.

Mapping

****Prepare maps and overlays indicating locations of the factors investigated in the environmental review.** These maps should reasonably draw upon (and be consistent with) available engineering master plans, facilities plans, zoning maps, flood designation maps, SCS soils maps, etc., but should clearly illustrate results of the inventories undertaken within the scope of the environmental review. The maps should

be prepared at a scale sufficient to make them usable in public presentations, but should also be reducible for use as public education tools.

Wastewater Management Policy

*****Using the results of the environmental review, develop a wastewater management policy which considers and addresses the need to develop sewer development plans, wastewater management districts, or other plans and programs consistent with public health protection. The wastewater management policy should:**

- clearly articulate applicable findings of the environmental review;
- contain clear statements regarding the legal status of particular resource areas defined and delineated in the attached maps;
- define requirements, and permitted and prohibited actions in support of the policy;
- specifically reference related town ordinances, and applicable state law, including enforcement provisions; and
- should describe the steps which the town plans to take in meeting the policy objectives in sufficient detail to allow for clear accountability, specifying dates when requirements will be in force and policy elements will be implemented.

*****Using verifiable results of the environmental survey, establish sewerage, wastewater management and zoning ordinances which make clear commitments to sound wastewater management, using resource data to support decision making. Wastewater management ordinances should clearly identify degraded areas to be sewerage, and timing of sewer extensions to be made into other resource areas. In areas unsuited to use of ISDS, lot sizing or other land management controls should be used to ensure adequate treatment capacity for effluent. In sensitive areas where sewerage is to be provided, developers should be required to tie-in to sewers if lot size variances are granted.**

****In consultation with health and environmental professionals, review existing RIDEM ISDS design and construction standards and findings of the ISDS Task Force and its research committees to determine whether the existing minimum RIDEM standards as implemented are adequate to protect the public health and resource values of the community. If this review indicates that standards more rigorous than the RIDEM minimum standards are necessary, adopt a municipal ordinance which provides for local standards, and identifies specific responsibility for implementation.**

Establishment of Municipal Programs to Address ISDS Concerns

The following recommendations expand upon those of the Regulations Subcommittee of the ISDS Task Force, and upon Division of Planning recommendations regarding implementation of Waste Water Management Districts.

*****As authorized by 1987 amendments to Title 45 of the R.I. General Laws, Chapter 24.5, initiate a general municipal septic system maintenance program or Wastewater Management District (WWMD) consistent with the water quality protection objectives stated in the Scituate Reservoir Watershed Management Plan (Division of Planning Report #62).**

A. Establishment of a General ISDS Maintenance Program

If a general municipal septic system maintenance program is initiated, it should be supported by adoption of municipal ordinances which, at a minimum, make the following provisions:

- a) ISDS should be pumped every three years as recommended by the Rhode Island Division of Planning (1979).
- b) Septic tank pumpers should be responsible for reporting to the office designated by each town those septic tanks not able to be pumped, or requiring pumping more than three times in one year.
- c) Any package plants located within town jurisdiction should be subject to specific maintenance and inspection requirements to be coordinated with DEM.
- d) A sanitation officer or Environmental Officer designated by each town should be responsible for reviewing ISDS permits issued by DEM. The designated officer would have the responsibility of ensuring compliance with local requirements and witnessing installation phases, in cooperation with DEM, to ensure compliance with DEM and town requirements. The witnessing program, which has been utilized successfully by Boards of Health in Massachusetts for more than a decade, allows town officials to develop first-hand knowledge of the land capabilities in the area. In addition, towns can assume responsibility for meeting their own water quality objectives. Costs of the as-built witnessing program would be passed on to applicants as fees.
- e) As an incentive to eliminate chronic ISDS malfunction and to protect future homeowners, information pertaining to failed ISDS or violations of state ISDS regulations should be recorded on property deeds until such time as they are corrected.

B. Establishment of Wastewater Management Districts

A district-based approach allows towns to concentrate municipal effort in areas where problems are most severe.

Adopt a municipal ordinance setting out WWMD policy objectives and providing for town authorities necessary to implement the Waste Water Management District. Although a number of administrative and management options may be considered, an ordinance should provide the town sufficient authority to:

- a) Provide for the passage of district officials and septage haulers onto private property as necessary to accomplish periodic inspection, maintenance, and correction of ISDS systems so as to protect public health.
- b) Institute an as-built installation witnessing program as outlined in c) above.
- c) Raise funds sufficient to provide adequately for the administration and operation of the district, and to allow the district to meet contractual obligations and service requirements in a professional and timely manner.

- d) Establish the necessary administrative, financial, technical, enforcement, maintenance, and legal structures to effectively implement and conduct district programs, and to hire the personnel necessary to support such structures in a manner which ensures protection of public health.
- e) Implement a public education program, preceding the implementation of a WWMD and as appropriate thereafter, to inform property owners as to the need for proper design, installation, maintenance, and care of ISDS systems, including avoidance of unsafe disposal practices.
- f) Receive grants and establish revolving funds to make grants and low interest loans available to individual property owners for the improvement, correction, or replacement of failed septic systems.
- g) Authorize and contract with independent septage haulers.
- h) Contract with other cities or towns for septage disposal through sewage treatment plants.
- i) Designate proper collection and disposal sites for septage collected by authorized pumping and hauling agents.
- j) In cooperation with other town authorities, provide for proper collection and disposal of household wastes unsuitable for disposal in septic systems and/or sanitary landfills.
- k) Any package plants located within WWMD jurisdiction should be subject to specific maintenance and inspection requirements to be coordinated with DEM.

Identify portions of the community which should be included in the WWMD and/or designate all of the community as appropriate for inclusion. High priority areas for inclusion which have been identified by the Division of Planning and the ISDS Task Force include a) homes served by on-site wells and septic systems; b) watersheds or aquifers which provide or have the potential to provide public drinking water; c) areas with a history or strong potential for failed septic systems as indicated by soil conditions; d) sites adjacent to high quality surface waters. Provide for formal delineation of adopted areas within the WWMD authorizing ordinance above.

With adjoining communities, consider adoption of joint WWMDs to complement inter-local facilities planning for sewage and septage disposal.

Evaluation of Options

Many of the issues surrounding establishment and implementation of WWMDs are discussed in detail in the Division of Planning Report # 62, cited above, which was designed to support the Division's efforts in providing assistance to towns in setting up WWMDs. The report describes options and makes specific recommendations regarding administration, staffing, septic system inspection, maintenance requirements, record-keeping, education, financing, provision of financial assistance, septage disposal, enforcement, etc.

Recommendations made by the Division of Planning in Report # 62 and by the ISDS Task Force, in addition to other pertinent recommendations, would potentially apply to different entities depending upon the mode of administration set up for the WWMD and the implementation responsibilities assigned to specific authorities. For example, existing sewer authorities or public works departments might reasonably assume certain responsibilities, while others would be handled most effectively by a new WWMD Commission or Board.

Although a range of organizational options are available to towns, certain criteria of accountability apply in common to any effective program, and are presented here:

- All commissions, boards or other public bodies are subject to the requirements of the R.I. open meetings law.
- All requests for variances and special exceptions made to the RIDEM ISDS Section should be forwarded (before action is taken) to the appropriate Town or WWMD authorities so that pertinent data on the system and affected areas can be collected and recorded in the WWMD accounting system, and so that consistency with WWMD and Town policies can be assured. RIDEM actions on such requests, and conditions attached, should also be forwarded to the appropriate Town or WWMD authorities so that data can be effectively recorded in the WWMD accounting system.
- All requests for variances and special exceptions above should be published as Town Notices. Requests and their outcomes, including conditions attached, should be published again as Town Notices before occupancy permits are issued.
- Records of requests for variances and special exceptions, and their outcomes, should immediately become deed encumbrances which are made available to potential buyers and financial institutions to support adequate system inspection as required at the time of transfer of property ownership.
- All agreements established between the WWMD/Town and property owners concerning results of failure evaluations, inspection and cleaning schedules, and other issues of potential concern to other affected parties, should have permanent effect, should immediately become deed encumbrances, and should clearly stipulate property owner and WWMD/Town obligations.

Zoning

*****Zoning density should specifically consider cumulative impacts of ISDS-related resource contamination and other non-point source pollutants associated with density, should reflect siting limitations identified in the environmental review, and should be consistent with public health protection objectives.**

*****Areas identified during the environmental inventory as having been developed beyond carrying capacity (for example, at densities of one residential unit per 1/2 to 1/8 acre or less) should be considered as having**

priority for extension of sewer lines and should not be subject to further development.

****In areas developed beyond carrying capacity, or in critical areas as defined by the ISDS Task Force Recommendations, undeveloped areas previously platted at extremely high densities should be re-zoned to provide for reduced density protective of water quality and public health. A minimum lot size of two acres should be considered in these areas.**

***In areas developed beyond carrying capacity, or in critical areas as defined by the ISDS Task Force Recommendations, lots of less than the minimum lot size which are in contiguous ownership should be combined prior to consideration of development permits.**

Overlay Districts and Other Municipal Controls

A range of resource protection objectives can be approached via the designation of overlay districts within town zoning controls or related authorities. By incorporating water resource protection into town ordinances, communities may encourage appropriate land use within the watershed area and may ensure high quality and sufficient quantity of drinking water supplies. North Kingstown obtained special zoning enabling authority from the state in 1974 and established overlay districts which have been used to enforce land management requirements specific to water quality. ISDS setbacks have been established in accordance with aquifer protection objectives, and the town offers financial assistance for upgrades. Similarly, Richmond and other communities have established aquifer protection overlays and Narragansett uses overlays in implementing its sewer policy. Warwick provides financial assistance for upgrading failed systems.

Several local resource protection programs implemented by towns in the Buzzards Bay watershed in Massachusetts illustrate the advantages which comprehensive programs can offer towns in enabling them to address cumulative effects of all pollutants. These programs, which place limitation on type and density of development, might prove applicable to Narragansett Bay watershed problems. (See Activities in Other States.)

ACTIVITIES IN OTHER STATES

Massachusetts

Massachusetts permits ISDS under authorization of Chapter 21 A Section 13, through regulations provided under Title V of the State Environmental Code. The regulations were designed as a minimum health standard to protect water supplies from bacterial contamination, and to ensure adequate siting and design of ISDS. Requirements govern the type and capacity of systems, location, installation, and maintenance. Any ISDS must be located and installed in such a way that "it will function in a satisfactory manner and will not create a nuisance or discharge into any watercourse. "Several site examination parameters are specified, and setback and separation distances designated.

Massachusetts is developing policies to address use of package plants in areas not passing Title V requirements. The Environmental Policy Act Unit (MEPA Unit) of the Executive Office of Environmental Affairs has determined that a Generic Environmental Impact study is needed in order to make responsible permit determinations, and will require Environmental Impact Reports for the numerous proposals which have already been submitted.

Local governments in Massachusetts may exercise considerable authority over development, land use, and public health issues. Town Boards of Health, in particular, may assume broad regulatory power. Under M.G.L. Chapter 111, Section 31, Boards of Health may adopt regulations to supplement Title V, strengthening applicable standard to sufficiently address local conditions and water quality problems. Ordinances and regulations may include requirements to protect water resources from nutrient and chemical wastewater pollutants as well as pathogens. Many municipalities have adopted local regulations which supplement Title V, providing for:

- a) seasonal restrictions on perc tests and determination of groundwater levels;
- b) hydrogeological survey requirements;
- c) joint wetland delineation and ISDS perc testing to ensure that percs cannot be performed within designated wetland buffer zone;
- d) increases in required setbacks from various receiving waters;
- e) as-built inspections (including providing for assessment of escalating inspection fees for each repeat inspection);
- f) designation of reserve siting area to use in the event of system failure;
- g) groundwater monitoring;
- h) pumping to ensure adequate separation to groundwater;
- i) specific upgrade requirements.

Bourne, Massachusetts

Bourne Board of Health regulations specify that coastal beaches, dunes, banks, barrier beach systems, and coastal lands subject to flooding are areas characterized by active sediment transport and highly fluctuating groundwater table. They are defined as "hazard prone areas in terms of potential public health and safety problems relating to drinking water quality, shellfish and fisheries contamination, and personal life and property damage. "The installation of new septic systems is prohibited in any area where there is active shifting sand or earth, or where the distance from naturally occurring ground elevation (exclusive of all fill materials) to observed high ground water elevation is less than six feet (two feet greater separation distance than required by state regulations, Title V).

Dartmouth, Massachusetts

The Town of Dartmouth, in the Buzzards Bay watershed, has a very strong program in place which has evolved over a number of years. Dartmouth uses two zoning overlay districts which provide separate provisions for inland wetlands and watershed protection and for coastal wetland protection. In these areas, permanent structures for human occupancy or structures with sewerage facilities may not be constructed.

Other prohibited activities include filling and earth removal, and alteration of water courses without a town permit. Strict conditions are attached to permits issued.

Dartmouth also applies a two-tiered overlay district program for aquifer protection. Within the areas of influence of municipal well, only non-intensive uses such as conservation, outdoor recreation, agriculture, and maintenance of existing structures are permitted. In areas of primary recharge to both existing wells and potential groundwater development, many site uses potentially contributing to aquifer contamination are prohibited.

Dartmouth Board of Health regulations and policy relating to ISDS installation and maintenance reference the overlay and aquifer protection districts, are quite rigorous, and have been applied successfully since the mid- 1970's. The Dartmouth ISDS regulations are reproduced in Appendix 2.1.

Falmouth, Massachusetts

Falmouth aquifer protection by-laws prohibit a wide range of site uses in designated areas, permit certain uses under specified conditions, and establish strict design requirements to control non-point contamination of the aquifer. For permitted uses, applicants must demonstrate that all proposed uses will not degrade current or future public water supplies. Development-induced runoff loadings must be calculated, and are used as input to a mathematical drainage-impact formula which predicts loading to the aquifer. Applicants must adjust design specifications to stay within impact limitations.

Falmouth requires that, where feasible, ISDS be located outside the aquifer protection district. Sewage loadings are specifically limited by lot area to 7.5 gpd per 1000 square feet of lot area.

Plymouth, Massachusetts

Plymouth uses a zoning overlay district to control development of areas having poorly drained soils, barrier beaches, and tidal flats. Strict conditions are attached to permits issued. Regulations prohibit filling of wetland to obtain sufficient area for leachfield construction, or to raise the leaching area. "The filling of land in order to provide the four foot minimum distance between the bottom of the disposal system and the maximum groundwater elevation is not considered an acceptable practice, and such lands are considered as not suitable from a sanitary point of view for human habitation."

Idaho

Panhandle Health District

A growth management approach developed by the Panhandle Health District, a multi-county health district in northern Idaho, guides implementation of policies and programs via the use of contractual agreements. It is based on the strong local perception that future growth should pay for itself.

Although the mechanism was developed to control ISDS contamination of the sole source aquifer shared by Kootenai County and Spokane, Washington, it could be applied to several other non-point categories of concern in the Narragansett Bay watershed as well, including release of VOCs into aquifers, retrofitting of dry wells for control of storm water contamination of groundwater, implementation of underground storage tank controls, and establishment of hazardous materials handling controls.

On the basis of results of an in-depth 16 month private well monitoring program which revealed high nitrate contamination levels, the PHD developed general aquifer protection regulations, drawing on its dual authorities to protect public water supplies and to issue ISDS construction permits. The regulations were design to limit dense development to areas which could be effectively sewered, and to ensure that, in unsewered areas, lot sizes

would be adequate to ensure sufficient effluent treatment. The two primary regulatory provisions specified that:

- Outside the incorporated cities and towns, PHD would not grant an ISDS permit -- necessary for new construction-- on lots less than five acres in size, and
- Inside the incorporated cities and towns, PHD would grant ISDS permits as long as the municipality had negotiated a contractual sewage management agreement (SMA) with the Health District.

The SMAs have several important features. Each starts with a group of tailored stipulations, enabling parties to the contract to recognize each other's responsibilities and roles. Secondly, each contract contains specific provisions tailored to the municipality in question which must be fulfilled in order for the PHD to continue to issue permits for new ISDS in the municipality. SMAs are negotiated annually by staff, but are approved by the mayor or town council of the municipality and the Board of the PHD.

A recent SMA with the Town of Athol, for example, included the following provisions:

- All new ISDS as required by the PHD must have the date of installation, location, size, and type of all components in the system recorded at the City Hall with the lot size.
- All ISDS should be pumped when sludge depth is one-third of the liquid depth of the tank, or every five years, whichever comes first. The city will give notification twice a year that ISDS should be pumped.
- The city shall annually report the number of systems installed, repaired, or pumped to the PHD.
- The city is not obligated to initiate planning or engineering for a collection and treatment system as long as the city does not exceed 397 ISDS within its legal boundaries.

Although the SMAs are generally concerned primarily with the siting of new ISDS and with the orderly construction of sewers and sewage treatment plants to replace them, operation and maintenance provisions are also included which apply in perpetuity in non-sewering areas. During the renegotiation of existing SMAs, the PHD has also included restrictions on the sale, use, and disposal (in ISDS) of all organic solvents.

Septic capitalization fees have evolved from the regulations. Developers are required to pay the applicable town a fee for each ISDS installed. The fee is based upon the cost of replacing the ISDS with a future sewer collection and treatment system as calculated in the cost-effectiveness portion of the towns Section 201 plan for designing and developing treatment facilities. The fee actually represents a discharge payment for the interim use of the treatment capacity of the substrate until sewer service can be made available.

The PHD has also been successful in dealing with large ISDS issues. In applicable SMAs, the PHD has required the city to assume responsibility for the operation and maintenance of any community drainfield installed after the inception of the SMA. The rationale of this approach was that community drainfields (used by subdivisions and

condominiums) were a "commons" without a single identifiable responsible owner and tended to be used and abused without receiving sufficient physical or financial attention. The location of large systems is carefully restricted, and town inspection, maintenance, and fee collection responsibilities are clearly stated in the SMA. The foreknowledge of town responsibilities tends to support zoning which adequately considers siting parameters.

A key advantage of the PHD approach rests in its flexibility. The SMAs can be tailored to accommodate spatial and temporal changes, and can include provisions for unusual local circumstances. The program has also allowed for effective delegation of responsibility to towns

Appendix 2.1

Town of Dartmouth, Massachusetts Regulations Governing Installation and Maintenance of Sewage Disposal Systems

1. The Board of Health of the Town of Dartmouth, Commonwealth of Massachusetts, acting under the authority of Chapter 111, Section 31 of the General Laws and amendments and additions thereto, and by any other power thereto, enabling and acting thereunder in accordance therewith, have, in the the interest of and for the preservation of the public health, duly rescind all previous Rules and Regulations pertaining to the construction of a disposal system adopted by the Board of Health, Town of Dartmouth, and have duly made and adopted the following Rules and Regulations pertaining to the construction or installation of local sewage disposal works.

2. The owner or other person or persons having control of any existing building or buildings hereafter converted into one or more stores or places of business, and in which one or more persons are employed, shall provide sufficient toilet facilities, and wherever a public sewer is accessible, shall, in a clean manner and within a reasonable period of time cause such stores or places of business to be connected with such public sewer.

3. When the water supply is to be from a private well, its production and purity must be tested and approved before a disposal works construction permit will be issued by this Board.

4. If the well is to be dug before the location of the house and/or the location of the septic system are determined, a plan must be submitted for approval showing the following: well location, contour lines, location of neighbors' wells and septic systems, elevation, any ledge or watercourse, lot dimensions, and percolation tests-- if any.

5. An individual sewage disposal system (ISDS) must be located upon ;the same lot of land as the dwelling, building or premises to be served by it.

6. When a septage waste pipe is connected to a public sewer line, any abandoned septic tank, leaching pit or cesspool must be removed or be filled with stone, sand or soil and then be inspected by Board of Health Agent or Member. (Dec., 1974)

7. All percolation and ground water tests and all septage system alterations requiring the presence of a professional engineer must be witnessed by a sanitary inspector appointed by the Board of Health.

7A. Before a lot is tested and witnessed for percolation rate and/or groundwater levels, the applicant shall submit a form A-1, REQUEST FOR FIELD TRIP, to the Conservation Officer. The Conservation Officer will visit the site and delineate the wetlands on parcels of five acres or smaller. Subdivisions or parcels greater than five acres shall have the wetlands delineated by a botanist and have the botanist's delineation approved by the Conservation Officer. Once the wetlands have been delineated or a delineation has been approved by the Conservation Officer, then a signed form A-1 will be furnished to the Board of Health as proof of compliance. The bounds of the lot shall be designated in the field by an engineer or land surveyor. (4/86)

8. The Board of Health authorized inspector shall inspect the construction of a new septic system at the following stages:
 - a. When a disposal area is excavated and septic tank is in place.
 - b. When distribution box and leaching pipes or leaching pit are in place and are not covered by stone. We recommend that an appointment for inspection must be made not less than twenty-four hours in advance.
9. Septic system plans are not designed for garbage grinders nor jacuzzis nor equivalent high water use plumbing fixtures. If they are to be used, then additional leaching area must be provided.
10. Five copies of the septic system plans, drawn to 1 inch equals 30 feet scale, are required.
11. The maximum ground water elevation shall be determined between December 1 and April 30. If rainfall and temperature conditions warrant, the test dates for ground water elevation may, on the order of the Board of Health, be extended or limited. The percolation rate shall not be determined during the months of August, September, and October. (6/87)
- 12A. Any primary percolation test with a percolation rate slower than 1 in ch in 2 minutes shall have a percolation test performed in the reserve area. (11/87)
12. When a sewage disposal works construction permit is brought to the inspector for renewal, the inspector shall examine the site to determine whether site conditions have changed or were previously ignored before a sewage disposal plan is approved. All sewage disposal plans must meet current board of Health and Title V (310 CMR 15.00 -- the State Environmental Code) requirements at time of reissue.
13. The following must be received by the Board of Health prior to issuance of occupancy permit: A certified statement by the design engineer that the system has been installed according to the approved septic system plan and must include an as-built drawing showing the final locations and elevations of the system components. (8/87)
- 13A. A Registered Engineer must provide the Board of Health office with a written certification of the foundation elevation as specified on the septic system plan. (10/84)
14. Two deep observation holes are a minimum requirement for each lot. The reserve area shall have the soil strata on the septic system plan.
15. There will be no overnight soaking of soil for percolation tests when the water does not drop from the measured 15 to 9 inches within the required thirty minutes. (4/87)
16. Area requirements for a Leaching Field only:
 - 1-2-3 bedroom house shall have 600 square feet minimum field.
 - For each additional bedroom above three, add 150 square feet.
17. No percolation test shall be taken within two feet of the original grade or in fill.

18. There shall be no "dewatering " of observation holes for the purpose of performing a percolation test.

18A. All percolation tests officially recorded by inspectors for the Board of Health before January 1, 1973 are declared null and void. (6/87)

19. Grease traps with a minimum capacity of 1000 gallons shall be installed for all restaurants with 75 or more seats erected or altered after this date of publication. (9/84)

20. Septic Tank Requirements:

1-2-3 bedroom equivalent shall have 1000 gallon tank.

A four bedroom house shall have 1250 gallon tank and 5-6 bedroom shall have a 1500 gallon tank.

21. Leaching Area Fields:

If covering soil is more than two feet in thickness, there must be one vent pipe installed and more if size of field requires. If cover material is impervious, the field shall be vented through the plumbing.

22. The camp, motel or cabin site shall be such that it is practicable to provide and maintain proper sanitary facilities. The location shall be on porous, well-draining soil, and shall afford facilities for obtaining a good water supply and a safe method of sewage disposal system.

23. Alteration regulations for Domestic Sewage Systems of not more than two thousand gallons per day:

The Board of Health inspector or two members of the Board shall:

1. Receive permit fee before construction is begun and give receipt.
2. Review any former plans, witness the current problem and the selection of the site for any part of the system to be changed as well as relationship to neighbors' wells and septic leaching areas.
3. Review alteration plan prepared by Professional Engineer or Registered Sanitarian.
4. If in dry months, review records of possible ground water tests in area made since 1981.
5. If a leaching pit of six foot depth is to be used, a test hole at least 132 inches deep must be dug. There must be four feet of pervious soil between bottom of pit and ground water.
6. Witness excavation, record soil layers and water elevation, placement of new tank, pit or field and stone just as for a New system.

24. Separation Distances: The following are Board of Health regulations which supercede Title V regulations:

Distances (1) (2) - No disposal facility shall be closer than the distance stated to the components listed in the following table. The distance shall be increased where required by conditions peculiar to a location:

Component	Septic Tank (feet)	Leaching Facility (feet)	Building Sewer (feet)	Privy (feet)
Well or suction line*	50	100(1)	(3)	100(1)
Water supply line (pressure)	(4)	(4)	(4)	(4)
Property line	10	10	--	30
Cellar wall	10	25	--	30
In-ground swimming pool	10	20	--	30
Surface water supplies, tributaries to reservoirs, including open and sub-surface drains	50 (2,5)	100 (1,2,5)	--	(5)100(1,2,5)
Watercourses Title V: 15.01	50 (2,5)	100	--	100 (2,5)
Subsurface drains	25	25	--	25
Leaching catch basin or dry well	--	25	--	25
Downhill slope - measured from top of leaching facility	150 times the slope (expressed as a fraction)			

Municipal wellOutside cone of influence

* Well regulations require that wells be installed a minimum of 15 feet from the property line.

- (1) 100 feet is a minimum acceptable distance and no variance shall be granted for a lesser distance except with prior written approval of the Dept. of Environmental Quality Engineering.
- (2) All distances shall be measured from the average of the mean annual flood elevation in inland areas and from Mean High Water in coastal areas.
- (3) 10 feet if constructed of durable corrosion resistant material with watertight joints, or 50 feet if any other type of pipe is used.
- (4) It is suggested that the disposal facilities be installed at least 10 feet from, and 18 inches below water supply lines. Wherever sewer lines must cross water supply lines, both pipes shall be constructed of class 150 pressure pipe and should be pressure tested to assure watertightness.
- (5) The applicant should be aware of his obligation to comply with the requirements of the Wetlands Protection Act, G.L., C. 131, SS 40.

25. The fee for observation of percolation and ground water tests must be at the Office of the Board of Health not later than 4:00 p.m., two days prior to the reserved date for the test.

26. Fee for permits may from time to time be changed by the Board.

27. Any variance granted by the Board to the above regulations shall be placed in the official Minutes of this Board.

28. Enforcement: State Environmental Code - Title I and Title V

Title I - 310 CMR 11.01 through 11.31.

Title V - 310 CMR, Part II, Variance, Section 15.02 through 15.24.

The enforcement of the regulation of the Board of Health may vary with respect to any particular case when in its opinion, (1) the enforcement thereof would do manifest injustice, (2) the applicant has proved that the same degree of environmental protection required under this Title can be achieved without strict application of the particular provision. Also see 310 CMR 11.11 - Variance. (9/86)

29. By issuance of any permit under these regulations or approvals pursuant to these regulations, the Board of Health of the Town of Dartmouth or any agent, or employee of it or any person acting for it, does not assume any responsibility for the successful operation of any sewage disposal system or portions thereof. No liability is incurred by the Town by reason of approval for construction of individual sewage disposal system plans. Approval by the Board of Health of individual sewage disposal systems is based on plans and specifications supplied by the applicant. No guarantee is intended or implied by reason of any advice given by the Board of Health or representative thereof.

30. Partial Severability: If any regulation, paragraph, sentence, clause, phrase, or work of these regulations shall be declared invalid for any reason whatsoever, that decision shall not affect any other portion of this code, which shall remain in full force and effect; and to this end the provisions of these regulations are hereby declared severable.

2.2 AGRICULTURE-RELATED SOURCES

Introduction

Eutrophication and sedimentation of estuaries and effective management of nutrient and sediment loadings has been a major issue for a number of years. Major efforts to reduce these loadings have formed the basis of programs in the Chesapeake Bay, and other large estuaries and in smaller systems on the Gulf Coast, Long Island, Cape Cod, and on the south shore of Rhode Island. The EPA Chesapeake Bay program estimated that agricultural lands, which contribute 60 percent of the nitrogen, 27 percent of the phosphorus, and much of the 9 million cubic yard loading of sediment to the system, are by far the greatest source of contaminants entering the Chesapeake estuary.

A much smaller proportion of the 1,061,000 acre Narragansett Bay basin is devoted to agricultural use, and most farm operations are small and interspersed among non-agricultural land parcels and population centers. For that reason, it is extremely difficult to distinguish agricultural non-point source pollution from other non-agricultural non-point sources in the Bay watershed. Construction activities, use of chemicals in home lawn-care, and stormwater runoff, for example, contribute certain contaminants which are also associated with agriculture-related pollutant loadings.

Analytical methods developed as part of the Nationwide Urban Runoff Program, and presently being researched at U.R.I., promise to increase the accuracy with which problem areas can be identified. Further development of the Rhode Island Geographical Information System will also be of critical importance in targeting control efforts. Until these tools are readily available, Conservation District staff and researchers must rely on limited existing source statistics and knowledge of site characteristics to gauge the magnitude of these problems. Available information indicates that agricultural sources, though of smaller magnitude than some other non-point pollutant sources, still deserve attention.

AGRICULTURAL INPUTS AS POLLUTANT SOURCES: ISSUES OF CONCERN

The nature and extent of agriculture-related non-point source pollution is directly related to the manner in which land is used and managed. Land resources used for agricultural purposes are generally managed intensively, and, if proper control measures are not established, may create concentrated sources of pollutants which induce complex cumulative effects. (Row cropping, for example, involves land disruption as well as application of chemical fertilizers and pesticides.)

The most visible source of surface water contamination due to agriculture is sediment erosion. On average, 25 to 40 percent of the soil that runs off a field reaches a waterbody (U.S. EPA, 1984). Although the disparity between gross erosion and sediment delivery precludes direct correlation of calculated erosion rates with water quality problems, several methodologies have been developed to estimate loadings. The potential for sediment delivery depends upon an individual site's soil characteristics, slope, climate, and proximity to surface waters. Resulting pollution levels depend upon crop type, tillage practice, and other management factors.

The potential water quality impacts of sediment erosion are numerous. Not only does the physical presence of soil particles in water affect physical quality (including light

availability, temperature, and viscosity), but materials usually associated with the soil itself are of key importance. Nutrients, metals, organic matter, pathogens and other organisms, and pesticides may have important effects even at very low levels. Although the chemistry of suspended soil material, deposited sediment, and their constituents are poorly understood, sufficient scientific evidence is available to justify the consideration of sediment per se as a pollutant. Many state water quality standards have incorporated this principle.

Much of the nutrient loading to receiving waters results from excessive application of fertilizers and improper incorporation of manure into cropland soil. Of the principal nutrient constituents (nitrogen, phosphorus, and potassium), nitrogen and phosphorus are the major contributors to accelerated eutrophication of water bodies. In Rhode Island, most cash crops grown receive heavy applications of chemical fertilizers. According to DEM statistics, roughly 70 percent of the fertilizer used in the state is applied to agricultural land, and animal wastes are applied in addition where available.

Early work by Redfield (1934) and subsequent research on a broad variety of estuarine systems has established that nitrogen is generally the nutrient limiting primary production in coastal waters. In Rhode Island's salt ponds, for example, annual dissolved inorganic nitrogen to phosphorus ratios average 7:1 to 10:1 in the larger, more saline ponds (Nixon and Lee, 1981; *in* Lee and Olson, 1985). Nowicki and Nixon (1985) suggest that phosphorus may also be limiting in the fresher portions of the ponds. Where background nutrient levels are low, such as in these systems, a minor degree of enrichment can rapidly induce eutrophication.

Nutrient loadings are also attributable to runoff from animal holding areas, feedlots, and other areas of livestock concentration. These areas contribute nutrients, organic matter, ammonia, fecal bacteria, and other microorganisms. The National Pollutant Discharge Elimination System (NPDES) applies only to large commercial feedlots, and regulates only the feedlot and not the disposal or land application of animal waste. Small operations, and waste handling and application practice, are of concern for non-point source management.

The magnitude of pesticide loading to receiving waters depends upon crop adsorption rates, soil type, precipitation, slope, chemical characteristics of the pesticide in question (solubility, molecular charge, complexing factors, etc.) and proximity of the application area to a waterway. In the long term, pesticide delivery averages only about 5 percent of total pesticide applied, but loadings may increase substantially where application is followed by storm events (potentially resulting in fish kills) (U.S.EPA, 1984).

A number of factors have altered patterns of pesticide use in recent years. Use of certain persistent chemicals has been banned, and application requirements have been mandated by regulatory actions. Newer pesticides are less persistent in the environment and pose reduced long-term risk potential, but are frequently more water soluble than older preparations. Pesticides in runoff water are of considerable concern, as toxic water-soluble chemicals may be more biologically available when freely waterborne than when bound to sediment. The newer pesticides thus pose greater potential to induce acute short-term impacts in surface waters and to affect groundwaters through percolation.

RESOURCE CONTAMINATION: ISSUES OF CONCERN IN THE BAY WATERSHED

Agriculture and forest lands cover 2/3 of the 1,061,000 acre Narragansett Bay Basin, which includes portions of nine counties in the States of Massachusetts and Rhode Island. Agricultural enterprises in the basin, though varied, primarily consist of small farming units interspersed among population centers, industry, and other non-agricultural land uses. Much of the \$65 million annual agricultural market value of the basin originates in intensive agricultural areas in Newport and Providence Counties, Rhode Island; and in Bristol, Plymouth, and Worcester Counties, Massachusetts.

Highly productive loamy soils in the basin's several significant farming areas produce important crops, including, corn, small grains, vegetables and fruit. Dairy, beef, hogs and poultry operations make up a viable livestock industry. Erosion, sedimentation, nutrient/pesticide runoff, and soil loss inventories were prepared during development of the Rhode Island 208 Areawide Water Quality Management Plan, and subsequently by the US Dept. of Agriculture Soil Conservation Service (SCS) and Agricultural Stabilization and Conservation Service (ASCS). These data indicate that at least in certain watersheds, erosion and sedimentation management and improved farm waste management are necessary in order to meet applicable water quality standards.

Although construction and urbanization are major sources of erosion and sediment problems, SCS calculated in 1984 that 400,000 tons of soil per year are lost per year to agricultural sheet and rill erosion in the Narragansett Bay basin. Of this, roughly 20 percent enters rivers and streams. Of total cropland in the Bay basin, over 30 percent is eroding at rates exceeding tolerable soil loss limits. (Tolerable soil loss is defined as the maximum loss of soil due to erosion (in tons/acre/year) which can occur without reducing the long term productivity of the soil.) Ephemeral erosion was estimated to contribute an additional 80,000 tons per year, with 25 percent entering rivers and streams.

Sediment loads are deposited in stream channels, and in ponds and reservoirs along water courses. Water supply storage capacity has been diminished in affected reservoirs on Aquidneck Island, and flood storage capacity has been lost throughout the Bay basin. Contaminated sediments trapped in impoundments, furthermore, may be flushed during major storm events, creating significant pulse loadings to the Bay. A major storm in April, 1987, for example, flushed impoundments in the Blackstone and Ten Mile Rivers.

Sales of fertilizer for agricultural use have steadily declined in Rhode Island, due to increases in fertilizer prices, higher analysis materials, lower application rates, and a decrease in the number of full-time farming operations. Nevertheless, fertilizers increase the pollutant potential of soils eroded into receiving waters, and are a source of concern in some areas.

Animal wastes, introducing nutrients, bacteria, and organic material into receiving waters, have also adversely affected basin water quality. Significant runoff originates from feedlots, holding areas, and streambanks where animals are allowed direct access to water courses. In addition, manure applied to fields may become a source of runoff contamination when incorporation in the soil does not occur, or where manure is spread on frozen ground. Of the estimated 337,000 ton annual production of animal waste in the basin, approximately 20 percent is produced from livestock operations which are so close to water courses that very limited natural filtration occurs before the waste residuals reach

the stream. Nineteen priority sites affected by animal waste were identified as part of the 208 Rural Runoff Inventory.

Animal waste constituents cause turbidity and eutrophication, which in turn affect color, taste, and odor, and increase the cost of treating the water for use as potable water supply. Sediment, excess nutrients, and agricultural chemicals further escalate water supply treatment costs.

The agriculturally related resource problems of Aquidneck Island have been given particular attention. Aquidneck Island was cited as the highest priority area in the state for the reduction of agricultural non-point sources of pollution in the RI 208 Areawide Water Quality Management Plan. Of the state's 53 highest priority watersheds identified during the planning process, 13 were on Aquidneck Island, and of these, 7 were in the top 8. The priority ranking of these watershed areas was based primarily on amount of sediment delivered to waterbodies and potential waterbody use.

In 1980, the Town of Middletown requested assistance under the Resource Conservation and Development (RC&D) Program in solving the agricultural non-point source water quality problems in its water supply watersheds. Although a Rural Clean Water Project proposed for the island in 1981 was never funded, an SCS Watershed Protection Project was initiated in 1984, sponsored by the Eastern Rhode Island Conservation District (ERICD).

Data collected during the SCS watershed planning investigations on Aquidneck Island has revealed disturbing trends. Excessive sheet, rill, and ephemeral gully erosion on cropland has caused reduction in crop yields due to erosion and sedimentation damage and due to depletion of the soil resource base. Further, water quality in streams and in 7 municipal water supply reservoirs has been impaired as a result of sediment, phosphorus, pesticide, and animal waste inputs from agricultural enterprises.

A Cropland Erosion Study conducted from May 1984 to March 1985 by the ERICD showed that the 2840 acres of Island cropland were losing a total of 25,900 tons of soil per year to sheet, rill, and ephemeral gully erosion. Although soils in the watershed have been assigned a tolerable soil loss limit of 3 tons/acre/year, 33 percent of acreage was eroding at up to twice the limit, 21 percent at 2-4 times the limit, and 27 percent at over 4 times the assigned limit. ERICD estimated that loss of soil depth would force abandonment of 300 acres in the next 30 years, and an additional 720 acres in 60 years.

ERICD found that erosion rates do not vary significantly with crop type, but do vary with slope. The economic value of nutrients lost, crop damage due to erosion, and loss of soil productivity exceeds \$200,000 annually in the watershed, with off-site sediment and water quality problems costing an additional \$20,000 per year.

Total sediment yield to the stream system is estimated to exceed 11,700 tons per year, with nearly 5300 tons of sediment delivered to the reservoirs annually. Nutrients associated with runoff and sediment have contributed to reservoir eutrophication, and oxygen depletion. Lawton Valley reservoir experiences periods of hypolimnetic anoxia. The contaminant inputs also result in increased treatment cost, taste and odor problems, and higher levels of trihalomethanes due to increased use of chlorine in treatment.

Evidence of pesticide contamination in reservoir sediments has caused considerable concern. Very low levels of pesticides were found in sediment samples in a 1984 survey. Although the water column showed no evidence of pesticide contamination, the long term effect of low level contamination due to slow release is unknown. Twenty of the 49 pesticides reported to have been used in agriculture on Aquidneck during recent years become bound to soil particles following application, and move into receiving waters complexed with sediment. The remaining 29 remain in solution and can enter receiving waters with runoff.

CURRENT RESPONSE TO WATER QUALITY PROBLEMS

In accordance with provisions of Section 208 of the Federal Water Pollution Control Act of 1972, the State of Rhode Island developed an Areawide Water Quality Management Plan (AWQMP) which identified 53 priority agriculture-related water quality problem areas of particular concern. Although erosion and sedimentation was found to be the state's most critical non-point source problem, the best management practices developed for the 53 priority areas were designed to address all related nutrient and contaminant loadings.

The Division of Planning, which prepared the AWQMP, designated the state's Conservation Districts as the management agency responsible for implementing the recommendations of the agricultural portion of the 208 plan. The three Conservation Districts, which have carried out programs for conservation of soil and water since 1945, were considered well suited to the task because of their experience with federal cost-share programs, their accountability to the State Conservation Committee (including representatives of DEM and state legislators) and their strong local contacts with the farming community.

Many of the AWQMP recommendations anticipated the availability of federal funding under the Rural Clean Water Program (RCWP), a joint EPA -SCS assistance program. The RCWP application was to have been based on priorities established in the 208 plan, and was to have involved coordinated action among several related agencies and administrative groups, including the ASCS, SCS, the Conservation Districts, DEM, and the Division of Planning. The AWQMP examined a range of issues important to implementation of the RCWP, and prepared a set of alternative RCWP approaches involving a range of program strategies and funding levels. While the RCWP funding program was discontinued, many of the 208 plan recommendations remain applicable.

Although federal funding available for agriculture-related non-point source management has decreased significantly since the beginning of the 1980s, a number of inter-related programs are operating in the basin, emphasizing proper animal waste management and erosion control on cropland. Five SCS field offices in the basin have 7.2 total staff years devoted to provision of technical assistance (3.8 years in Rhode Island; 3.4 years in Massachusetts), which is provided in cooperation with Conservation Districts. The following sections summarize the roles and responsibilities of agencies and organizations involved.

Conservation Districts

Conservation Districts are local units of government organized by local residents under state law. The Rhode Island Conservation Districts follow county boundaries. Under the Rhode Island State Conservation Law, each District is responsible for soil and water

conservation work within its boundaries. District governing board members are locally elected or appointed by the State Conservation Committee. Conservation District boards plan and carry out long-range programs and provide guidance to the SCS regarding local needs and priorities. At the request of the district board, SCS assigns a district conservationist and a staff to provide technical assistance to the district and its cooperating land user "clienteles."

The Rhode Island State Conservation Law assigns a broad mission to Conservation Districts, giving these bodies considerable responsibility to address non-point source problems, including agriculture-related ones. The statutory definition of responsibility is as follows:

Powers of Districts and Directors:

".....(9) To prepare and keep current a long-range program for the conservation of all of the renewable natural resources of the district. Such program shall be directed toward conservation of resources for their best uses and in a manner that will best meet the needs of the district and the state, taking into consideration, where appropriate, such uses as farming, grazing, timber supply, forest, parks, outdoor recreation, water supplies for urban and rural areas; water for agricultural and industrial uses, watershed protection, control of soil erosion, retardation of water runoff, flood prevention and control, protection of open space and scenery, preservation of natural beauty, protection of fish and wildlife, the prevention or reduction of sedimentation and other pollution in rivers, streams, reservoirs, and the protection of groundwaters, and the location of urban facilities and structures will fit the needs of the state and be consistent with the best uses of the renewable natural resources of the state. The program shall include an inventory of all renewable natural resources in the district, a compilation of current resource needs, projections of future resource requirements, priorities for various resource activities, projected timetables, descriptions of available alternatives, and provisions for coordination with other resource programs; to prepare an annual work plan, which shall describe the action programs, services, facilities, materials, working arrangements and estimated funds needed to carry out the parts of the long range program that are of the highest priority. Each district shall submit to the state committee a copy of its long-range program and annual work plans for review and comment."

In Rhode Island, the three Conservation Districts place varying degrees of emphasis on particular functions, based on the conservation needs in the district. The Eastern District has assumed an important role in helping towns protect water supplies, and places strong emphasis on groundwater and watershed protection (including erosion control and stormwater runoff management) in addition to agricultural resource protection. In the face of rapid development in Newport County, it is emphasizing farmland preservation and addressing the environmental problems of an urbanizing landscape. The Northern District places its greatest emphasis on preparation of resource and livestock management plans and implementation of conservation practices on farms located within the Scituate Reservoir watershed. Towns also call on the district to review erosion and sediment control plans. The Southern District is midway between the two in its emphasis.

In Rhode Island, in contrast to many other states, Conservation Districts are funded at an extremely low level by the state. Each District normally receives one to two thousand dollars annually from appropriations to DEM. For the upcoming fiscal year, no funds have been made available, as all such funds have been pooled to support the hiring of a part-time

staff person to promote use of the state's erosion and sedimentation enabling legislation in all of the towns in the state. Conservation Districts conduct annual seedling sales to generate funding, and solicit funding from municipalities to which they provide technical assistance. Occasionally, workshop revenues exceed costs, contributing minimal supplemental funding.

U.S. Dept. of Agriculture (SCS and ASCS)

Through the Conservation Districts, SCS provides technical assistance to landowners and others in many forms: evaluating soil suitability for various uses; planning and carrying out long-term conservation programs; evaluating alternative land uses and treatments for controlling runoff, erosion, and sedimentation; determining where conservation practices are practical and necessary; preparing conservation plans; and designing and laying out best management practices. For landowners and operators, SCS also inspects and certifies proper installation of the practices.

SCS assists local governments in carrying out natural resource inventories, planning resource use, evaluating the potential and limitations of soils for various uses, setting up non-point source control programs, and implementing cross-jurisdictional Resource Conservation and Development programs.

Technical assistance is also available through the Resource Conservation and Development Program (RC&D), another U.S.D.A. affiliated program. Through the Rhode Island Resource Conservation and Development Council, located in East Greenwich, towns can obtain assistance from environmental review teams whose membership includes experts from the federal and state governments and academics. Towns have drawn on the RC&D program to provide assistance in evaluating large developments, and in addressing the needs of critical areas. Each RC&D area has its own goals, but most provide a wide variety of assistance in conservation and community development. Training programs are also offered. The Rhode Island RC&D recently offered a much-needed program on state wetland and coastal regulations for building inspectors and planning departments.

The Agricultural Stabilization and Conservation Service (ASCS) allocates roughly \$100,000 per year to agriculture-related resource conservation and non-point source control through ongoing or special projects. A majority of that allocation is directed through the ASCS Agricultural Conservation Program (ACP). The ACP offers cost sharing for soil, water, and forestry practices of long-term benefit. Since 1983, when the most extensively used practices were cover crop and other management practices, the ASCS and SCS have placed increasing emphasis on permanent conservation practices.

Cooperative Extension Service - County Offices

Finally, county offices of the Cooperative Extension Service provide technical assistance to landowners regarding agricultural and horticultural practices. In recent years, due to rapid suburbanization and the decline in numbers of working farms, Rhode Island Extension offices have placed increasing emphasis on assistance to homeowners, rather than to the agricultural community. Cooperative Extension Service assistance to agricultural operators is now generally provided by Extension specialists at the University of Rhode Island.

All of the agencies involved in efforts to minimize the adverse effects of agricultural waste and erosion on water quality would like to encourage expanded installation of effective conservation practices. The major conservation practices advocated in a 1984 SCS proposal to focus on the Narragansett Bay Basin as a specific Target Area included: animal waste management systems, filter strips, critical area plantings, conservation tillage, cover crop, contour stripcropping, pasture management, terraces, diversions, grassed waterways, and water and sediment control basins.

GENERAL FINDINGS

Although vigorous efforts have been made to encourage installation of agricultural best management practices, progress has been slow. A number of important economic and sociological factors contribute to implementation difficulties.

In important areas of the Basin, ASCS/SCS targeting strategies are not having optimum effect because many farm operators in critical areas or in areas having significant impact have not chosen to participate in the strictly voluntary program.

Conservation District staffing levels are not adequate to ensure regular post-installation inspection and verification of practices put in place on farmlands. No enforcement authority is available to SCS to ensure consistent maintenance of practices.

No consistent monitoring strategy has been developed to ascertain the water quality impacts of practices and the long-term effects of the practices on farm costs and productivity. As a result, the effectiveness of the practices cannot easily be demonstrated to farm operators, in economic terms or in terms of on-the-ground or in-the-water contaminant measurements.

GENERAL RECOMMENDATIONS

****An assessment should be made as to whether a purely voluntary program is sufficient to address identified needs, even if funding and support were broadly expanded. Other economic and regulatory approaches should be seriously investigated. The existing sediment and erosion control statute should be amended to remove its agricultural exemption, and town ordinances should likewise. The Rhode Island Water Quality Act should be broadly interpreted so as to enable the state to take action in cases of significant water quality degradation.**

*****Most product sale prices inadequately reflect the cost of conservation practice installation. To allocate cost of practice installation fairly among the operator (who generally cannot exert control over product sale price) and the average 70 consumers which an operator provides with food and fiber, sufficient state cost share funding must be made available to ensure that all applicable operators are financially able to participate in appropriate non-point source control programs.**

*****Conservation district funding and staffing levels should be augmented to enable the districts to carry out expanding responsibilities.**

****Rhode Island and Massachusetts should develop consistent monitoring programs to measure practice effectiveness in terms of farm costs and benefits and site-specific water quality improvement.**

*****Effective conservation plans should be developed for all farms within critical areas.**

SPECIFIC PROGRAM FINDINGS AND CONCERNS

COST SHARE PROGRAMS FOR AGRICULTURAL BEST MANAGEMENT PRACTICES

Findings and Concerns

ASCS/SCS cost share programs provide incentives for conservation practice installation. The percentages differ among various practices, and depend on the type of agreement reached between an operator and SCS. In the Aquidneck Island Watershed Protection Project, for example, average federal shares per unit range from \$25 for contour farming to \$2500 for installation of an animal waste management system.

Even given the careful targeting of SCS efforts toward Aquidneck Island, via the Aquidneck Island Watershed Protection Project, funding for agricultural non-point source control is severely stretched. On the national level, program direction has been changed to provide a state allocation which may be focused according to state priorities.

ASCS and SCS have made a number of attempts to augment funding available for agricultural conservation practices. In 1981, ASCS applied for allocation of \$1.2 million in Rural Clean Water Program funds for the East Bay Project, a major water protection effort, and applied for \$100,000 in Special Project Agricultural Conservation Program (ACP) funding for two project areas. The multi-faceted East Bay Project was turned down, but \$42,000 was awarded for Special Projects in Newport and Washington Counties, which was spent primarily on soil erosion control. Three ACP Special Project requests were made in 1982, for a total of \$93,000, to undertake farmland projects in Kent and Washington Counties and in the Scituate Reservoir watershed. \$38,000 was awarded for application to all three projects.

When the Special Project Funds program ended in 1983, Rhode Island and Massachusetts made an effort to obtain USDA Target Area designation and funding for the entire basin. The Target Area proposal, again unsuccessful, would have made the area eligible for supplemental conservation funds, totalling \$225,000, to address the critical needs of the basin.

The lack of continuity in program direction at the national level has had negative impacts in the Bay basin. Much staff time has been diverted from program responsibilities to proposal preparation, and the credibility of the program as a whole has suffered, in spite of the dedication of the technical staff within ASCS, SCS and the Conservation Districts.

The cost share provisions themselves are complicated and have been subject to fluctuation. The PL-566 share of the cost for enduring practices, such as terraces, are equal to or less than those set for ongoing programs such as the ACP, or not more than 65 percent. Cost share is limited to the amount which would apply with installation of the

most cost-effective system. Maximum PL-566 cost share funding for control of agricultural runoff-related pollution is limited to 50 percent of the cost of the most cost effective system, and a similar 50 percent limit applies to waste management facilities. A one time flat-rate payment of up to 50 percent of the cost of adoption may be made for contour farming.

Funding caps are also applied to the cost share arrangement. Previously, a cap of \$3500 per year was applied, regardless of the distribution of an operator's costs over time. Currently, the ASCS provision for long-term agreements provides for initial outlays of up to \$35,000, but an operator must agree to undertake an equal amount of expenditure over a ten year period to balance the \$3500 per year federal commitment.

Frequently, the costs of implementation go well above what has been anticipated, and the long-term agreement provision can do little to alleviate the situation. Some animal waste facilities range in cost from \$12,000 to \$35,000. As a result, the federal cost-share incentive is often inadequate to encourage a farmer to implement practices. A state cost share matching program for animal waste management facilities enacted in Rhode Island for FY 87, though limited, has helped to alleviate the problems of cost uncertainty. Under the new program, which was enacted as a two year effort, a total of \$20,000 per year for two years is provided to match federal cost share contributions to projects. The state will provide 40 percent cost share, again, up to an annual cap of \$3500, and USDA will provide 75 percent, up to the same cap. Combined cost share cannot exceed 90 percent, but the increased incentive was sufficient to increase applications to SCS for participation from an annual average of one to two per year to 13 in 1987.

The cost-share problem is exacerbated by a fairly widespread misconception among many farmers (and some field office personnel interviewed) that SCS "overdesigns" projects according to standards that are excessively rigorous. Actually, the standards are established to ensure that practices will function properly for their design life. Design life for structural practices is 10 to 25 years. Unfortunately, operators are aware that ASCS occasionally awards payment to operators whose constructed projects are not fully approved by SCS. In some cases, the observed inconsistencies tend to inspire skepticism and poor compliance.

Recommendations to ASCS/SCS

*****Ensure that consistent definitions and terms apply, with regard to satisfactory practice completion, among ACSC, SCS, the Conservation Districts, state officials, and any other decision-makers guiding implementation.**

****Ensure that lessons learned throughout the project life of the Aquidneck Island Watershed Protection Project are circulated among the basin's farming community. Establish demonstration projects and on-site observation programs.**

****Consider establishing "watershed neighbors" networks to enable operators facing similar control needs to circulate results of practice installations among themselves.**

Recommendations to the Rhode Island General Assembly

****Expand the agricultural land management assistance program to include subsidization of agricultural soil erosion control measures as well as agricultural waste control measures.**

Recommendations to the Rhode Island Dept. of Revenue

****Designate particular tax revenues to targeted agricultural BMP cost share support so that the two year limited program supporting installation of animal waste control measures can be extended until all priority projects have been undertaken. The State of Indiana has designated revenues from its vice tax to this purpose.**

Recommendations to Local Governments

***Towns should coordinate upcoming development of Comprehensive Plans with participation in the state's Farm, Forest, and Open Space Act programs.**

****Assessors should take into account the reduced value of land fenced off from streams, adjusting tax valuations accordingly.**

IMPLEMENTATION OF AGRICULTURAL BEST MANAGEMENT PRACTICES

Findings and Concerns

Although the technology applicable to agricultural non-point source control is well established, several important factors impede installation of BMPs, including implementation of sound land use and treatment systems. Some of these are sociological, while others are strictly financial.

First, it is important to understand all of the steps involved in implementation of a farm conservation plan. SCS provides technical assistance to :

- determine the applicant's need based upon the severity of the problem;
- evaluate and determine an individual's priority status for assistance, in consultation with the applicable Conservation District;
- work with individual participants to consider alternatives and to develop comprehensive conservation plans addressing proper management of soil and water resources;
- design conservation practices intended for implementation;
- lay out and inspect structural and land treatment practices; and
- implement management practices.

In spite of the availability of start-to-finish assistance of this quality, a major sales effort on the part of SCS and the conservation district is involved. First, farmers must be convinced that they are actually causing non-point source pollution, when little if any site-

specific monitoring evidence is available to show cause and effect. This is frequently difficult given the nature of inputs and the diversity of potential sources.

Second, operators must be convinced that a conservation practice will address the problem and will prove cost-effective in the long run. Insufficient funding for establishment of demonstration projects in the state has made it difficult to demonstrate the effectiveness and economic efficiency of practices. At the same time, news regarding the outcome of the Westport, Massachusetts RWCP project has not been encouraging, though special factors were at issue in that effort (See Activities in Other States).

Assuming that the need is identified, many practices are major financial undertakings, requiring careful weighing of numerous cost and benefit factors. As outlined in the previous section, too, capital cost levels are difficult to anticipate, and maintenance cost and effectiveness are difficult to gauge.

Land values are such that many operators are reluctant to enter into expensive installation agreements and long-term maintenance efforts when faced with extremely strong incentives to sell property. For farmers who do anticipate selling, it is difficult to second guess market factors which might govern timing of sale in the future.

In addition, many operators rent a portion of the land they cultivate. Fears of losing rented land to development, or of taking on major capital and maintenance requirements without guaranteed income from rented property are major issues in farmers' decision-making. Operators who lack real ownership control over the land they use are reluctant to embark on long-term installation and maintenance contracts, even at 75 percent cost share.

Once the cost scoping process has been completed, SCS personnel work with operators to plan practices. This process may require a matter of months, during which an operator must apply for state wetlands permits, CRMC permits, and meet other applicable requirements. The design and approval process can take several months or a year. The "red tape" associated with the state permit process was cited by several interviewees as a major frustration to potential applicants, and is presently being reviewed by ASCS, SCS and RIDEM.

The net result of the complexity and cost surrounding installation of conservation practices is that operators are reluctant to participate. As in the Chesapeake Bay basin, program administrators have stated that the programs are failing to elicit participation from the farmers whose operations pose greatest risk to the watershed. As a result, administrators solicit participation among the operators of lower priority farms. Although these farms, too, need to install BMPs, the cost share dollars are frequently not spent in the locations of most critical concern.

REGULATORY OPTIONS AND ENFORCEMENT

Findings and Concerns

Presently, the Rhode Island Sediment and Erosion Control Law, which is an enabling act providing towns authority to enact their own provisions, exempts agriculture from consideration. This major omission, though common to many states, needs to be corrected. Similarly, existing state law governing discharge of waste to receiving waters, and requiring adequate treatment, can be interpreted to apply to agricultural discharge.

In numerous states where agricultural non-point source programs have been put in place, strictly voluntary programs have been less successful than those which involved some imposition of regulatory standards as a fall-back incentive. (See Activities in Other States.) This is particularly true when available staff resources are inadequate to ensure regular, timely inspection of installation and maintenance routines. Where local erosion and sedimentation programs have been put in place, compliance levels have been directly correlated with inspection frequency. As Conservation Districts are currently unable to visit individual sites more frequently than once a year, proper maintenance is expected to become an increasing concern.

Recommendations to the General Assembly

*****Adopt state legislation establishing state-wide minimum standards for erosion and sedimentation control to supplement existing enabling legislation providing for local sedimentation and erosion initiatives. (See Chapter 2.5.) Specify basic program elements which will be administered by the state (primarily through the Conservation Districts), and conditions under which specific authorities may be delegated to local governments having approved programs which exceed the stringency of state requirements. Revise existing legislation to eliminate exemption for agricultural activities. Designate critical areas in which special standards will apply (See Recommendations to RIDEM, below). Provide funding authorization sufficient to:**

- provide pass-through assistance funding to towns having approved by-laws for resource inventory and problem assessment;
- provide pass-through funding to towns having approved programs exceeding the stringency of the proposed state program for a portion of local program operating expense; and
- provide for DEM, CRMC, and Division of Planning staff support to ensure state oversight and adequate technical assistance for local program development and implementation.

*****Provide on-going funding for Conservation Districts which is sufficient to enable the districts to: assist local governments in developing and implementing erosion and sedimentation programs; provide technical assistance to farmers, monitor BMP maintenance and effectiveness, and implement other programs as necessary to meet their responsibilities in ensuring effective control of agriculture-related non-point source pollution.**

****Amend the tax-exempt provisions of Chapter 44-3-3(22) to apply to the installation of best management practices. Any real or personal property acquired or altered to control pollution from agricultural land uses should be given the same tax-exempt status as property acquired to control industrial pollution.**

Recommendations to RIDEM

****Under the authority of the Water Quality Act, develop an enforcement strategy to apply to farm operators who have been targeted and approached by SCS, are not proceeding with**

SCS to install BMPs, and whose operations are significant sources of water quality degradation.

****Under the authority of the advocated sediment and erosion control statute (or within the provisions of the existing sediment and erosion control statute as revised to eliminate the exemption of agriculture), and in cooperation with Division of Planning floodplain management goals, establish regulatory standards for agricultural operations to require installation and maintenance of BMPs where voluntary compliance through SCS programs is unsuccessful. Establish farm standards strictly limiting erosion and restricting discharge of any sediment or runoff which:**

- a) lowers the flood storage capacity of the floodplain or increases watershed flood hazard;
- b) adversely affects aquatic life;
- c) contributes to sedimentation of a wetland or area subject to flooding;
- d) increases the areal extent of the floodplain of which the area at issue is a part.

****Under the authority of the existing Water Quality Act, establish farm standards which include mandatory stream fencing and animal density limitations that:**

- a) significantly reduce animal access to creeks, streams, drainage ditches, or other water courses;
- b) prevent to the maximum extent possible animal access to intermittent water courses, areas subject to flooding, or other drainage areas;
- c) significantly reduce improper application of manure and excessive numbers of animals per acre so water quality may be protected; and
- d) reduce discharge of contaminated runoff to receiving waters.

****Consider requiring farmers to install a "chemical work area" (as is currently required in Connecticut), as a condition of renewing DEM pesticide use and restricted pesticide use licences.**

****Establish a pesticide container return program (such as the one currently in force in Maine) requiring that monetary deposits be made at the place of purchase.**

***Significantly expand DEM Toxics Disposal Days to allow for convenient, safe disposal of household chemicals, pesticide and lawncare products, and other harmful substances. A new program should be developed through DEM and the Conservation Districts to provide opportunities for safe disposal of agricultural chemicals by commercial operators.**

CONSERVATION DISTRICTS

Findings and Concerns

The Conservation Districts in the Bay basin provide critical institutional linkages and perform numerous important functions in non-point source control. The demands being placed on the districts are changing with urbanization. (See Chapter 2.3 on Erosion, Sedimentation, and Stormwater Runoff.) Loss of working farmland in the Basin, and increased municipal emphasis on control of development impacts have required the districts to broaden the emphasis of their efforts. Municipalities have become strongly dependent on the districts, relying on district technical assistance in review of development plans and other implementation efforts.

Districts presently have no staff, other than part-time secretarial support. District Conservationists, who are SCS employees assigned to serve district needs, meet most of the requests which come to the districts. However, they are prevented by the overall SCS mandate from undertaking enforcement activities. Because of the longstanding close working relationship which the districts have with farm operators, these quasi-governmental organizations are in a unique position to effect positive change. Since the formulation of the AWQMP, Rhode Island has placed considerable reliance on the Districts, and plans to expand their role in upcoming implementation of broader non-point source controls. In many other states, districts are well-funded and serve as the key local focus for major programs. Rhode Island must develop district staff if new responsibilities are to be met.

District funding is completely inadequate to meet increasing, and increasingly diverse, demands. The ERICD, for example, solicits roughly \$2000 total per year from municipalities to which it provides technical assistance, and is working with those towns to develop methods to solicit funds from other sources. The other Districts receive even less municipal funding. Given the importance of district activities, funding must be increased.

Recommendations to RIDEM/R.I. Dept. of Revenue

Provide on-going funding for Conservation Districts which is sufficient to enable the districts to inventory sources, provide technical assistance to farmers, monitor BMP maintenance and effectiveness, and implement other programs as necessary to meet their responsibilities in ensuring effective control of agriculture-related non-point source pollution.

Recommendations to Conservation Districts

****In cooperation with the Division of Planning, complete an inventory of existing municipal controls relating to sediment and erosion control, runoff and drainage management, floodplain management, aquifer protection, open space protection, and critical area protection.**

*****Work with SCS/ASCS to promote installation of best management practices on all Basin farms, giving priority to those in critical areas or creating significant adverse impacts.**

*****Work with municipalities to encourage development of land use management programs in critical Basin watersheds to improve water quality.**

****There is a need for greater involvement on the part of the State Conservation Committee and the state association of District governing board members to promote coordination among the three districts. Districts might benefit from development of a joint research agenda to address common needs. Public education and technical assistance materials should also be prepared cooperatively.**

****In cooperation with other districts, develop district-specific and statewide research agendas to address specific impediments to installation of BMPs. For example, since operators have expressed concern that more corn is stolen by passersby when rows run parallel to highways, districts might consider developing a crop theft case study, comparing costs and benefits of contour plowing with costs and benefits of plowing to discourage theft of harvest.**

***Working with SCS, develop a research inventory to identify differences in management practice between operator-owned and rented lands. Consider developing incentives to encourage improved management of rented lands.**

*****Expand district staff to meet the rapidly increasing demand in all districts for technical assistance, program review, education programming, and enforcement assistance. At a minimum, a full time staff employee should be available in each district to perform each of the following functions:**

- assist in development of conservation plans for all farms in the Bay basin; assist in inspection and enforcement (assuming a statewide statute is enacted mandating preparation of conservation plans);
- assist municipalities in development and implementation of erosion and sedimentation control programs;
- assist municipalities in development and implementation of runoff control programs;
- develop educational materials and promote control of agriculture-related non-point source pollution;
- develop educational materials and work with Cooperative Extension Service County agents, garden clubs, and other organizations to promote control of non-point source pollution resulting from home use of fertilizers, pesticides, and other household chemicals;

*****Explore all avenues available in providing assistance necessary to help maintain farming as a viable enterprise. In that regard:**

- a) inventory all owners of farmland within the district;
- b) foster communication among farmers and landowners;

- c) work with RC&D program to improve markets for crops, livestock, and other agricultural products;
- d) coordinate closely with DEM's open space and agricultural land preservation programs;
- e) develop or adapt educational materials which promote purchase of development rights, use of conservation easements, formation of land trusts, and other farmland protection methods. Numerous resource materials are available, including, for example, publications of Save the Bay, the Connecticut Land Trust Service Bureau, the Conservation Law Foundation of New England, the Institute for Rural Massachusetts at the University of Massachusetts, and the Nature Conservancy.

****In cooperation with SCS and Cooperative Extension Service agents, develop an expanded information and education program on non-point source control issues:**

- a) Sponsor field days with SCS, local officials, interest groups, and members of the farming community. Establish demonstration plots, and hold group meetings, workshops and tours to show land users how resource management systems or best management practices are applied and how the resulting benefits may be measured.
- b) Develop a special information program and materials for livestock producers. Explain the effect of agricultural waste on water quality, the benefits of managing agricultural waste as an economic resource and the assistance available to land users with agricultural waste problems.
- c) Develop slide sets and video tapes for distribution to Cooperative Extension Service County agents for their use with educational programs.
- d) Work with URI to enhance communication between agricultural operators and the scientific community. Conservation districts are well-positioned to share results of scientific findings and demonstration projects with farmers and to help focus research efforts on local needs and issues.

Recommendations to the Rhode Island Department of Revenue

****Consider developing a tax relief program for Rhode Island agricultural operators who have worked with SCS to prepare farm conservation plans, and are actively participating in sound agricultural non-point source management efforts. In addition, there is a need for up-front financial assistance to enable many operators to meet the match requirements of practice installation.**

2.3 STORMWATER AND SEDIMENT

Introduction

The surge of development which has taken place in the Narragansett Bay Basin within the past fifteen years has had numerous implications for the water quality of Narragansett Bay. Urbanization has brought significant hydrological changes to bay watersheds. Not only are erosion and sedimentation changing the configuration of drainage areas, but urban runoff volumes and peak discharge levels are increasing at the same time that the quality of runoff water is declining.

Rhode Island's Areawide Water Quality Management Plan cited erosion and sedimentation as the state's number one non-point source problem. More recently, urban runoff has been identified as the source of very significant contaminant loadings to the Bay. The Nationwide Urban Runoff Program research indicated that runoff from lower density residential and urbanizing areas may also contribute significant nutrient and chemical loadings.

Longstanding efforts to alleviate flooding problems associated with decreased infiltration area on a site have yielded well-established structural solutions to stormwater management, but these solutions have neglected water quality considerations, and have often contributed to water quality degradation.

Similarly, erosion and sediment control have focused on flooding and drainage considerations, neglecting factors determining water quality impact. In recognition of the need to closely coordinate stormwater and erosion control programs and technical controls for maximum effectiveness, this chapter addresses the two related issues jointly. Special problems relating to road deicing and impacts of lawn-care related contaminants are approached in a separate section.

THE STORMWATER AND EROSION CONTROL COMMITTEE

In the fall of 1986, DEM formed a technical advisory group to develop guidelines for stormwater management and erosion control. The initiative was undertaken in response to several factors: a) specific issues of immediate concern in the Scituate Reservoir watershed; b) a generally perceived need for technical guidance among resource managers, regulators, and project designers; and c) the necessity of developing new program direction as mandated by requirements of the new federal Clean Water Act amendments. The committee was composed of professional engineers, academics, state regulatory staff, municipal staff, and representatives of federal technical assistance programs, water supply providers, and regional sewer authorities.

The objectives of the committee were threefold:

1. Develop standards and specifications for design and construction of stormwater management facilities;
2. Update the R. I. Erosion and Sediment Control Handbook for land development; and

3. Prepare guidelines for application of stormwater management/erosion controls to protect high quality waters of the Scituate Reservoir, with standards for Class B and C waters secondary. Such guidelines should be suitable for use on a trial basis by DEM staff currently reviewing stormwater discharges under applications for Fresh Water Wetlands Permits and Water Quality Certification. (Meeting Summary, 10/29/86)

A number of key issues and concerns were identified by the Committee as being important in developing technical standards and guidelines. Some policy issues raised in addition to specific technical considerations included

- feasibility of implementing stormwater controls through existing state regulations (Fresh Water Wetlands Act, State Building Code) and expansion of local authority with appropriate enabling legislation;
- need for aquifer protection; necessity of adhering to anti-degradation policy in development of stormwater management standards for the Scituate Reservoir watershed;
- eligibility of highway-related stormwater management/erosion controls for Federal Highway Administration (FHWA) funding, especially those constructed solely for water quality enhancement purposes;
- need for integration of stormwater management controls and erosion controls to maximize efficiency;
- limitations of stormwater controls in controlling existing flooding problems; issue of water enhancement vs. flood control in developing design standards for stormwater management and erosion control;
- need for monitoring and enforcement of erosion controls during construction;
- need for public education to ensure acceptance of stormwater management and erosion controls; and
- water quality problems associated with combined sewer overflows.

During the period from October 1986 through December 1987, the Committee met regularly to prepare technical guidance and develop an implementation strategy for stormwater management and erosion control. With regard to stormwater management, DEM prepared technical background materials and formulated specific technical recommendations which were reviewed, re-worked, and accepted by the full committee. The Connecticut Handbook, representing the most up to date and detailed guidance on practices was used as the basis for the Committee's work. Subcommittees were formed to technically develop specific Soil Erosion and Sediment Control practices.

As in the case of the ISDS Task Force Report, with its attachments and recommendations, the Stormwater and Erosion Control Committee final report should be considered an essential planning tool and technical manual for state and municipal agencies developing stormwater management programs. The report "Recommendations of the Stormwater Management

and Erosion Control Committee Regarding the Development and Implementation of Technical Guidelines for Stormwater Management," should be published for broad circulation.

Similarly, the revised and updated Rhode Island Erosion and Sediment Control Handbook for land development should be finalized and published for broad circulation as soon as possible. The Handbook represents a thoughtful and careful distillation of several states' erosion control experience, and a scrupulous adaptation of that experience to Rhode Island hydrologic and geologic conditions.

THE WETLANDS TASK FORCE

DEM's Freshwater Wetland Section is presently responsible for administering regulatory provisions of the Rhode Island Freshwater Wetlands Act as amended in 1985. The wetlands protection programs (including Wetlands protection and Water Quality Certification) are the sole regulatory authorities currently used by DEM in regulating runoff (DEM, 1986). As such, the authority available within the scope of these programs, and the use of that authority, is of key importance in sediment and runoff control.

In June 1985, the Director of DEM created a Wetlands Task Force in response to rising public dissatisfaction regarding time delays in permit processing and administrative interference in staff permit review and decision-making. The Task Force began deliberations in June 1985 and completed its regular meeting agenda in January 1986. Task Force members included state regulatory staff, academics, and representatives of environmental, business, and civic groups having technical expertise in wetlands. Two subcommittees were formed: one to investigate and make recommendations concerning the role of the director in specific wetland permit applications, and the other to recommend technical and policy changes regarding program operation to the entire Task Force.

The findings and recommendations of the Wetlands Task Force were never presented to the public, although the report is considered a public document. This is unfortunate, as the findings were important and deserve public comment and review. Many findings relate specifically to non-point source pollution problems, however, and corroborate findings of the present research effort. Specific Task Force findings and recommendations are included in subsequent sections.

STORMWATER RUNOFF AND SEDIMENT AS POLLUTANT SOURCES: ISSUES OF CONCERN

The following sections outline major concerns associated with sedimentation and stormwater runoff, as summarized from Scheuler (1987) and other sources. Although these findings reference a range of geographical areas, all concerns discussed are applicable to the Narragansett Bay Basin.

Alterations in Watershed Hydrology

Beginning with the process of site clearing and grading, development alters watershed hydrology. As construction proceeds, impervious rooftops, roads, parking lots, sidewalks, driveways, and other surfaces reduce percolation in such a way that rainfall is virtually completely converted to runoff. Structural drainage "improvements" made to

direct and convey excess runoff in the watershed accelerate the process of hydrologic alteration. Net effects of development on watershed hydrology include:

- increase of peak discharge two to five times above pre-development levels;
- increased volume of storm runoff produced by each storm (a moderately developed watershed may produce 50 percent more runoff volume than a similar forested watershed during the same storm);
- decreased time of concentration (time required for runoff to reach a watercourse) by up to 50 percent, especially if major drainage improvements are made;
- heightened frequency and severity of flooding, increasing frequency of bankfull discharges several fold;
- reduced streamflow during prolonged periods of dry weather due to reduced level of infiltration in the watershed; and
- greater runoff velocity during storms, due to the combined effect of higher peak discharges, rapid time of concentration, and smoother hydraulic surfaces resulting from development.

Stream channel geometry is also affected by urbanization, resulting in the following responses:

- channel widening, with consequent severe erosion of unconsolidated, highly erodible floodplain soils;
- increased flood risk due to elevation of stream floodplain to accommodate higher post-development peak discharge rate;
- gradual undercutting and slumping of streambanks, with loss of vegetation which triggers a second phase of bank erosion; and
- severe sedimentation of channel areas, such that channel habitat substrate is blanketed with deposits of sediment.

Alterations in Estuarine Hydrology

Depending upon the flushing rates of estuaries, and other factors related to the nature of the material and the receiving waters, sediment loading can have significant physical impacts. Development of breachways connecting coastal lagoons and open waters can alter circulation patterns so as to induce rapid sedimentation. Impacts documented in Rhode Island salt ponds due to alteration of breachways include:

- loss of water depth;
- increased turbidity, reduced light penetration;
- alterations in temperature regimes;

- alterations in pond hydrology; and
- changes in flushing patterns and salinity regimes.

Export of Contaminants via Sedimentation

Unless sufficient erosion controls are installed and maintained at construction sites, very significant loadings of sediment are delivered to receiving waters, carrying attached soil nutrients, organic matter, and complex contaminants. While sediment loads from agricultural land use on steep slopes in Rhode Island may range up to 25 tons/acre/year (USDA SCS (1986)), uncontrolled construction site sediment loads on the order of 35 to 50 tons per acre have been reported (Novotny and Chesters, 1981).

Effects on ecosystems are complex, involving physical and chemical components. In streams, the physical shift from natural flow and channel conditions reduces habitat value, affecting diversity and abundance of aquatic life. Several studies have demonstrated reduced diversity, and have shown a shift to more tolerant species (Ragan and Dietmann (1976) in Schaefer, 1987). In estuaries, changes in flow regimes can have broad impacts on flushing and salinity regimes, significantly altering habitat character.

Degradation of Ecosystems

Urban Runoff

Following site stabilization, pollutants accumulate rapidly on impervious surfaces and are readily washed off with precipitation. Urban runoff contains a myriad of complex contaminants, including trace metals, hydrocarbons, crankcase oil, pet droppings, suspended solids, vegetative matter, litter, debris, pesticides and fertilizers from home lawns and golf courses, and other constituents.

Each class of contaminant generally comes from numerous different origins. For example, inputs of three classes of polycyclic aromatic hydrocarbons (PAHs) may be primarily attributed to atmospheric deposition, sewage effluent, and crankcase oil (Hoffman, 1984). Similarly, trace metals originate from numerous sources (including leaded fuel, building materials, paints, wood preservatives, catalytic converters, brake linings, and tires). In turn, source inputs depend upon local conditions. Leaching and corrosion of metal surfaces, for example, is exacerbated by acidity of precipitation.

The nature of the impacts associated with specific runoff contaminants is reviewed in the subsequent sections, along with the development situations which create greatest resource vulnerability.

Sediment

Concentrations of suspended sediments in receiving waters cause a range of adverse impacts, including increased turbidity and viscosity, reduced light penetration, reduced prey capture, clogging of gills/filters of fish and invertebrates, reduced spawning and juvenile fish survival, and reduced recreational use (see also Chapter 2.2 on Agricultural Non-point Sources). Deposited sediment may smother or impair the function of benthic communities, alter the composition of substrates, and fill impoundments and embayments. As an efficient carrier of toxicants, nutrients, and trace metals, sediment serves as a

temporary sink for these materials, which may be remobilized during storm events or dredging operations, posing further environmental hazards (Galvin and Moore, 1982).

Nutrients

Excess nutrient levels in runoff can lead to eutrophication of receiving waters (see also Chapter 2.2 on Agricultural Non-point Sources). Nitrogen is the limiting nutrient in most coastal waters, while phosphorus is controlling in freshwater systems, and in some fresher portions of estuaries (Nowicki and Nixon, 1981). NURP research has indicated that typical nutrient concentrations in urban runoff are sufficient in themselves to stimulate eutrophication, absent the input from point sources. In runoff, nutrients may be present in soluble forms which are readily taken up by algae and other primary producers. Eutrophication processes are affected by numerous factors, including retention times and flushing rates, seasonal and climatic factors, inputs of other sources, etc. Generally, nutrient export is largest from development sites having greatest impervious area, or from golf courses, cemeteries, and other intensively landscaped areas.

Light penetration and availability is also an important factor in algae response. Maintenance of conditions suited to sustained growth of native macrophyte communities may be very important in preventing noxious algal blooms. Similarly, protection of indigenous riparian plant and tree buffers may prevent excessive algae growth in tributary streams (Moreland, 1985).

Pathogens

Almost without exception, runoff from urban and suburban areas contains bacteria at levels exceeding public health standards for water contact recreation (Koppelman et al., 1982). Pathogens (including *Enterobacter aerogenes* and *Streptococcus faecalis*), in addition to fecal bacteria and viruses, have been documented to occur in runoff (EPA, 1983). Bacterial levels may exhibit a twenty-fold increase between winter and summer, due to increased reproduction rates, multiplying potential hazards for recreational use and consumption of seafood. Combined sewer overflows from intensively developed urban areas and overland flow of domestic waste from failed septic systems produce the most significant levels of coliform bacteria, as these sources export bacteria derived directly from human wastes.

Oxygen Demand

In lakes, estuaries, and slow-moving sections of receiving waters, decomposition of organic matter by microorganisms depletes dissolved oxygen levels. Depletion of oxygen due to urban runoff is difficult to measure. First, the BOD test (which expresses the amount of easily oxidized organic matter present in water) relies on bacterial growth, which is inhibited by trace metals. Secondly, the COD test (or chemical oxygen demand test) measures all oxidizable material, including that which does not contribute to oxygen demand, and is therefore poorly correlated with oxygen depletion.

Nevertheless, urban runoff has been shown to severely depress DO levels in adjacent waters after large storms, yielding BOD levels exceeding 10 to 20 mg./l. Pulses of such runoff input have led to periods of anoxia (zero oxygen conditions) in shallow, slow-moving, or poorly-flushed receiving waters (EPA, 1983). Again, the most significant

BOD loadings originate from older, highly impervious residential areas having outdated combined sewer overflows, failed septic systems, and large pet populations.

Oil and Grease

Of the range of hydrocarbon compound constituents of oil and grease, several are toxic to aquatic and marine life at low concentrations. Primary sources of hydrocarbons in urban runoff are atmospheric deposition, leakage of crankcase oil and other lubricants from automobiles, disposal of used crankcase oil, and spillage at storage and transfer points. Hydrocarbon levels are highest in runoff from parking lots, roads, and service stations. Because hydrocarbons have a strong affinity for sediment, much of the hydrocarbon loading to runoff eventually adsorbs to sediment particles and settles out, where it accumulates in bottom sediments. Hydrocarbon persistence is a major concern. Not only have hydrocarbons been shown to persist in freshwater and estuarine sediments for long periods of time, but chronic adverse impacts on benthic life have been documented (Whipple et al., 1979; Whipple et al., 1981; Tanacredi and Stainken, 1981).

Trace Metals

Sampling research conducted as part of the Nationwide Urban Runoff Program revealed detectable levels of a range of metals in urban runoff: arsenic, beryllium, cadmium, chromium, copper, cyanide, mercury, nickel, lead, selenium, thallium, and zinc (DDN, 1982). Of these, cadmium was found in many samples, and lead, copper, and zinc were found in most samples, and occasionally at levels an order of magnitude greater than EPA's recommended criteria levels for aquatic life. (Trace metal inputs are geographically variable; estimated concentrations for Narragansett Bay are discussed below.)

Toxic Chemicals

"Priority pollutant" scans were conducted during the NURP studies to determine the extent to which more than 120 toxic or carcinogenic chemicals or compounds could be associated with runoff. Because the runoff scans were primarily conducted in suburban residential areas, sources of toxic pollutants were limited to illegally or improperly disposed household wastes, such as waste oil, paint thinners, preservatives, and pesticides. Priority pollutants detected in a Washington, D.C. area scan included 10 pesticides (at levels near the limits of detection), bis(2-ethylhexyl) phthalate (a plasticizer), and several phenols and creosols associated with wood preservatives. Runoff samples collected from existing or abandoned industrial areas have revealed other toxicants.

Chlorides

Chlorides applied to remove ice and snow from roads, parking lots and sidewalks, and improperly stored road salts, are very frequently introduced into receiving waters. Novotny and Jones (1986) reported snowmelt chloride levels exceeding several thousand milligrams per liter, or approaching the salinity of major estuaries such as Chesapeake Bay. Because of chloride's extreme solubility, virtually all chloride applied to surface areas is delivered to surface or ground waters (Pitt, 1985). Substantial chloride levels may have been found to be toxic to freshwater and inshore estuarine species, which are adapted to fairly narrow salinity ranges.

Thermal Impacts

Organisms adapted to coldwater fresh or marine environments may be seriously affected by an increase in water temperature of a few degrees above ambient conditions. Thermal enrichment problems may be critical for tributary streams as well as for coves or enclosed embayments exhibiting well-defined thermal regimes. Several factors influence summertime water temperatures in these areas, and of these, certain factors may act synergistically to increase water temperature.

A heated urban landscape significantly warms any runoff passing over it. Unless streambanks or channels are shaded, runoff enters receiving waters at elevated temperatures. The Vermont Upland Stream Study found shoreline shading highly significant in maintaining temperature and light penetration regimes necessary for protection of native fish populations (Moreland, 1985). In addition, runoff stored in shallow wet ponds or other impoundments is heated between storms, and may release pulses of warmed water following storm events.

ISSUES OF CONCERN IN NARRAGANSETT BAY

EROSION AND SEDIMENTATION

Rhode Island's AWQMP concluded that erosion and sediment control would be necessary in order for the Narragansett Basin's waters to meet applicable water quality standards. Unacceptable erosion and sedimentation problems exist in many urbanizing areas and agricultural areas. (See Chapter 2.2 on Agricultural non-point sources.)

Erosion attributable to urbanization or urban sources in the Bay Basin totals roughly 178,000 tons per year (USDA SCS, 1984). Of this total, the majority occurs at construction sites where removal of vegetation has exposed underlying soil for most or all of the construction period. SCS estimates that erosion rates of 30 to 40 tons per acre per year can be expected on construction sites, and that at least 4500 acres are disturbed annually in the Bay Basin as a consequence of development (USDA SCS, 1984).

In inland portions of the Basin, much of the sediment delivered to waterways is deposited in stream channels or in wetlands, ponds, reservoirs, or other impoundments along the drainage system. Sediment has accumulated in numerous such impoundments, reducing storage capacity by as much as 50 percent and significantly affecting flooding potential in certain watersheds (SCS, 1984).

In the Providence River, sediment accumulation has severely limited use of commercial and recreational ports, and has created a major dredged spoil disposal problem. Pickart and Boothroyd (1987), in studies of the physical stratigraphy of the river, determined that sediment accumulation in channels was 5 cm/yr, while Pawtuxet Cove accumulation ranged from 2 cm to 5 cm per year. The authors acknowledge that riverine accumulation rates exceed values reported for the upper and lower Bay by 1.5 to 4.5 cm/yr. Although calculated sedimentation rates for the Bay as a whole show great variability and inconsistency, King, et al. (1987) are undertaking a detailed stratigraphic analysis of a network of sediment cores which should improve understanding of conditions and processes throughout the Bay.

Sufficient information now exists, however, to support the assertion that the Bay acts as an effective pollutant trap via sedimentation processes. Several water column processes act on chemicals introduced to the Bay, including photodegradation, uptake by organisms, biological degradation, volatilization, dilution by mixing with more seaward waters, aerosol formation, and sorption to suspended particles with removal to sediments.

Of these processes, biochemical scavenging and retention in sediments tends to trap pollutants within the Bay. In an effort to learn to what extent sediment scavenging limits the effects of dilution, Hinga (1987) is developing a model of Bay scavenging which treats scavenging and dilution as competing processes, and omits consideration of other removal processes. Given the fact that seasonal trends in scavenging rates and water residence time in the Bay interact to maximize warm-weather retention and minimize cold-weather retention, Hinga postulates that more than 50 percent of all pollutants with a partitioning coefficient exceeding 500,000 would be retained in summer. Since many or most of the pollutants affecting Narragansett Bay have partitioning coefficients within one to two orders of magnitude of the latter threshold, Hinga asserts that significant retention is occurring, according to the model's prediction. He warns that mixing and dilution with offshore waters should not be relied upon to reduce chemical contaminant inputs to trivial concentrations in the Bay.

In coastal areas generally, sediment frequently reaches wetlands, estuaries, and harbors. Sedimentation has caused alteration of circulation patterns in small embayments within the Bay system. Severe habitat alterations have resulted from changes in circulation patterns, increased turbidity, loss of light penetration, shifts in temperature and salinity regimes, and other factors attributable to sedimentation. Alterations documented in the Rhode Island salt ponds include: shift in dominant vegetation type; loss of range of available habitat for fish and shellfish, and consequent shift of species assemblages; and loss of spawning and nursery habitat areas supporting commercial fishery species (CRMC, 1985).

Siltation, clogging of slips, and related impacts of sedimentation have become major sources of controversy in several harbors and marinas around the Bay, where maintenance dredging is advocated by property owners and the marine and recreation industries. Concerns regarding resuspension of sediment-bound contaminants, and dredge spoil disposal, have been raised by opponents of routine dredging.

Use of lower salt to sand ratio mixes in deicing has affected sediment loading, in ways which should be accounted for in sediment management. In an effort to determine the role which deicing sand plays in sediment accumulation in detention basins, DEM conducted a survey of towns in 1986/1987 to determine sand application rates. An average application rate was determined to be 28.7 tons of sand/mile/year based on responses of six towns (Stormwater Management and Erosion Control Advisory Committee Notice and Minutes, 11/19/87).

URBAN RUNOFF

Urban runoff is the major source of non-point source pollutant input to Narragansett Bay, contributing, for example, 48 percent of the petroleum hydrocarbons, 3 percent of the lower molecular weight PAH, 44 percent of the higher molecular weight PAH, 65 percent of the lead, 56 percent of the zinc, and 5 percent of the copper entering the Bay watershed annually (Hoffman et al., 1984). Runoff characteristics and loadings vary widely, among source areas and within the same area through time. Loadings are closely related to land

use. Among five Pawtuxet River watershed towns, for example, loadings of copper attributable to urban runoff varied by more than a factor of ten (Hoffman et al., 1984).

Non-urban "urbanizing" or "suburban" areas are also very significant sources of runoff, contributing a range of nutrient and chemical contaminant loadings. Although the generic term "urban runoff" applies to runoff from these areas in addition to densely populated land, the characteristic contributions of these areas merit distinct management attention. Urbanization per se has the net effect of increasing pollutant export by at least an order of magnitude over pre-development levels. (Issues of particular consequence in suburban areas are identified within the following sections.)

Several research methods have been employed to evaluate specific pollutant loadings, and their sources, and to compare point and non-point source inputs. Hoffman designed a research effort to examine hydrocarbons and PAHs in runoff as a function of land use in a manner similar to the approach used for other components in the NURP studies. The investigators found strong correlation between urban runoff pollutant loading and land use (Hoffman and Quinn, 1984).

In a related investigation with the objective of producing urban runoff estimates for the Bay as a whole, Hoffman (Hoffman et al., 1983) and her colleagues monitored storm drains serving different land uses, and utilized land use data to estimate runoff deliveries to storm drains, a treatment facility, and combined sewer overflow discharge points. For example, the authors calculated that, in Providence on an annual basis, 47 metric tons of hydrocarbons were discharged by separate storm drains, 20 metric tons were discharged via combined sewer overflows, 100 metric tons went to the treatment during rainy conditions, and 222 metric tons were delivered to the treatment plant during dry conditions.

Highway Runoff

Highways are an important source of several contaminants to the Bay watershed. In a study of the chemical and physical characteristics of highway runoff, and implications for treatment, Hoffman and Quinn (1984) found highways to be very significant sources of high molecular weight PAHs, Fe, Mn, Cu, Pb, Cd, Zn, and suspended solids. Highways contributing over 50 percent of the total input of suspended solids, PAHs, Pb, and Zn (77 percent) to the Pawtuxet River, despite the fact that they occupy only 8 percent of the watershed area .

In the same study, Hoffman also noted that the hydrocarbon concentration in the river sediments downstream of the highway discharge had increased by 89 percent at a depth in the core corresponding to 1970 to 1972 (after I-95 and I-295 opened in 1967) compared to the 1965-1966 section of the core. Although the total increase in concentration cannot be attributed to the interstate construction, highways clearly contribute an important part of the pollutant load in urban areas.

Results of a separate Bay study (Waterman and Hoffman, 1987) correlating land use with traffic volume indicate that rapid suburbanization, population growth, and construction of interstate highways have significantly affected highway runoff. Particularly in southern coastal communities, increase in traffic volume and the development of open space and wetlands have resulted in increased runoff from the highway system into the Bay. The study confirmed earlier results of Hoffman et al. (1983, 1984) which had

indicated that entry of standard urban and highway runoff is substantially affected by greater traffic volumes and by the destruction of wetlands.

Waste Oil Disposal

In order to determine the Bay pollutant loading attributable to improper disposal of used crankcase oil, Hoffman et al. (1981) surveyed 1000 Providence residents. Waste lubricating oil is disposed of in various ways by the 35 percent of Providence residents who change their own automobile lubricating oil (Hoffman et al., 1980). Methods included garbage can disposal (41 percent), backyard dumping (30 percent), disposal down sewers or storm drains (8 percent), return to a service station (7 percent), pouring the oil on the road (5 percent), and disposal at the town dump (3 percent).

On a weight basis, road or sewer disposal can account for 44 metric tons of hydrocarbons discharged into the city's combined storm and sanitary sewage treatment system, or 19 percent of the total hydrocarbons discharged by the city plant. Disposal on land, or in dumps (directly or via solid waste collection) also contributes to deterioration of Bay water quality, due to contamination of land runoff, urban runoff, and groundwater, though inputs due to these sources are difficult to measure.

Using the Providence results to predict waste oil contributions of each city and town in the Bay drainage basin, the same authors classified each town as urban, suburban, or rural and applied appropriate data sets to derive metals and PAH constituent loadings. The authors calculated that waste oil dumped down sewers alone (not including CSOs, overland flow, or other disposal methods) accounts for 132 tons per year contribution to the watershed.

Hydrocarbons

Within the major classes of hydrocarbons, sources vary significantly. While urban runoff accounts for 48 percent of total hydrocarbons, it contributes only 3 percent of low molecular weight PAHs, which are found in high concentrations in used crankcase oil and in drips of crankcase oil on the street surface, but are weathered prior to incorporation in urban runoff. In petroleum products discharged directly to the sewer system, the low molecular weight PAHs are not exposed to weathering, and are preserved. Heavier PAHs formed during fossil fuel combustion are not weathered to the extent that lighter petroleum compounds are, but are at lower concentrations in sewage and crankcase oil, so that atmospheric deposition becomes the principal source of these compounds (Hoffman, 1985). Urban runoff accounts for 71 percent of total high molecular weight PAH inputs to the Bay. The annual rate of total PAH and total aromatic hydrocarbon urban runoff inputs to the upper Bay watershed is approximately 1.0 and 51 grams per capita per year, respectively (Hoffman et al., 1984).

Hydrocarbon input budgets for the Narragansett Bay watershed have been developed which distinguish between spillage and other inputs contributing to runoff or discharge via sewage treatment plants or CSOs. Latimer (1984) collected oil spill data from three state and federal data sets and showed that the amount of oil spilled and reaching receiving water varied broadly, ranging from 2830 gallons in 1982 to 35,587 gallons in 1976. Fuel oil is the oil most frequently spilled in the Bay area, and, in terms of volume, the greatest spillage occurs at bulk oil storage terminals followed by truck accidents and industrial discharges.

Mean annual oil volume entering receiving waters of the Narragansett Bay watershed was 11,900 gallons, or 40 tons per year (Latimer, 1984).

Heavy Metals

Metals are also derived from various sources in the Bay watershed. Urban runoff is the primary source of lead, presumably due to use of leaded fuel in automotive vehicles. Lead derived from this source is an exhaust component, and is a component of highway oil drips. Lead concentration in runoff has decreased over time due to greater use of unleaded fuel. Bay copper is primarily industrial in origin; over 50 percent comes from the Providence wastewater treatment plant. Zinc is derived from treated sewage and urban runoff (Hoffman et al., 1984)

Suspended Solids

As outlined in previous sections, the importance of settleable solids in determining the fate of urban runoff constituents should be carefully considered in developing management strategies. Hoffman et al. (1984), in studies of the Pawtuxet River, found that a number of pollutants, such as petroleum hydrocarbons, PAHs, and lead were primarily associated with particles. Using sediment accumulation results from outer Boston Harbor adjusted to an area the size of Narragansett Bay, the same authors estimate that the Bay removal rate for higher molecular weight PAH should approximate 400 kg per year. Again, noting the similarity in chemical distribution of the higher molecular weight PAHs between urban runoff and Bay sediments, and the similarity in estimated inputs and sedimentary accumulation rates, the authors point to circumstantial evidence that urban runoff PAHs strongly influence the composition of coastal marine sediments, especially close to cities.

In the highway runoff characterization study, Hoffman et al. (1984) found that flow weighted mean concentrations of total suspended solids and settleable solids were 332 mg/l and 199 mg/l respectively in runoff from an interstate highway sampling station; i.e., 62 percent of the solids were settleable. Total suspended solids loadings factors for all land uses (in kg/ sq km of land use per year) were 4400 for single family residential use; 32,400 for commercial shopping mall; 548,000 for heavy industry; and 424,000 for 8 lane highway. Nationwide Urban Runoff Program factors for the residential and commercial shopping mall uses were 12,200 and 54,300 respectively (EPA, 1983).

Pathogens

Stormwater discharges are increasingly recognized as a major factor in pathogen-related closure of Bay areas to shellfish harvesting. Bacteriological monitoring conducted during the NURP investigations, in the Rhode Island salt ponds, and in Buttermilk Bay, Massachusetts indicate that stormwater is a source of very significant loadings. These results may be applicable to many areas of the Narragansett Bay watershed where similar soils, drainage patterns, hydrogeological conditions, and settlement patterns exist.

Recent research in Buttermilk Bay, sponsored by the Buzzards Bay Project, suggests strongly that stormwater inputs are the most important factor causing recent shellfish area closures, and that coliform levels are positively correlated with extent of residential development. Warm weather also contributes to increased density, while frequency of rain events is associated with lowered density at discharge points. Dry weather surveys of each surface drainage area in the Buttermilk Bay watershed show that the source of the fecal

coliform is not sanitary waste, but is attributable to dogs and wildlife. Using measured fecal loadings from dog waste, the authors predict that the volume of dog waste necessary to account for the overall geometric mean value of fecal coliform in discharged runoff could be supplied by a two to three day accumulation (Heufelder, 1988).

The impact of animal populations on an adjacent waterbody is governed by a number of factors relating to the probability of the waste being entrained in stormwater and the survival characteristics of the waste. Entrainment is affected by the percent of impervious area in the drainage basin, and by the drainage characteristics of the remaining lawns, landscaped sites, and other land uses. In urbanizing areas, drainage is primarily designed to deliver runoff to storm drains, shortening delivery time to receiving waters. Regarding survival of the wastes, sunlight and cold weather inhibit coliform survival, while warm weather enhances survival and reproduction. In that regard, turbidity increases survival by inhibiting light penetration in receiving waters (Heufelder, 1988).

Other conclusions of the same study regarding release of pathogens from protected "reservoirs" may be of additional relevance in Narragansett Bay. Heufelder (1988) found that within Buttermilk Bay both the sediment and decaying eel grass and wrack remaining after ebb of tide served to act as reservoirs and accumulators of fecal coliform. When dislodged or eluded by tidal action or storm events, coliform held in these sources returned to the water column, "possibly resulting in severe degradation of water quality in addition to that imparted by the existing storm drains."

Groundwater entering Buttermilk Bay was also found to contain entrained fecal indicator organisms. Factors governing entrainment of bacteria and viruses are complex (see related chapter on ISDS), but saturated conditions are known to promote bacterial entrainment to groundwater. Storm or recharge events increase the velocity of lateral groundwater flow, resulting in the movement of entrained pathogens to the "breakout point" to the Bay itself. Mechanisms of transport of organisms across the "breakout barrier" interface between saturated soil and estuarine waters are poorly understood, but the author suggests that groundwater inputs may account for some observed loadings (Heufelder, 1988).

GENERAL FINDINGS

Although some important tools are already in place, stormwater management and sediment/erosion control authorities need to be further developed, refined, and updated. The lack of state stormwater management legislation is a major impediment to effective action, and needs to be rectified. Similarly, the existing sediment and erosion control statute requires strengthening. Statutory language in both cases should include statements of findings, implementation steps, priorities, responsibilities, and adequate funding authorizations, and should specifically reference related state and federal requirements.

As in other non-point source issue areas, institutional arrangements which are in place to address stormwater management and sediment/erosion control are unable to anticipate cumulative effects of development on water quality. DEM's antidegradation policy is not presently being implemented in a manner which allows effective evaluation of incremental impacts. Similarly, CRMC has been unable to use its coastal ecosystem protection mandate to adequately evaluate and mitigate potential cumulative effects.

SPECIFIC PROGRAM FINDINGS AND CONCERNS

DEM WETLANDS REGULATION UNDER THE FRESHWATER WETLANDS ACT

Findings and Concerns

Jurisdictional Issues

The Wetlands Section of DEM regulates the altering of wetlands and has authority to require that a fifty foot buffer be maintained around swamps, marshes, ponds, and bogs. Activities inducing "alteration" include any filling, excavating, grading, draining, or construction in or near wetlands, and the discharge of any effluent into a wetland. The definition of "wetlands" is broad, covering areas of "storm flowage," and including areas within 100 feet of streams less than 10 feet in width and within 200 feet of streams greater than 10 feet in width. All areas within the 100 year floodplain are also within the program's regulatory jurisdiction. The Wetlands Section involves CRMC in permit review where the area of concern is within the coastal contiguous zone.

The broad definition of wetlands provided in the Act gives the Wetlands Section authority to consider effects of development on interconnected components of wetland systems. In the past, evaluation of buffer corridors has been used as a context in which to look at the larger wetland setting in which an alteration is proposed. The Wetlands Section's authority to take this approach has been confirmed by DEM legal staff. Consideration of impacts on floodplains and flowage characteristics also clearly provides authority to address aquifer protection, as wetlands and recharge areas are inextricably connected (Section 2-1-18).

In practice, however, permits issued for projects of limited scope and conditioned on the basis of laterally measured buffer zones cannot adequately address cumulative effects on interconnected wetland systems. The fifty foot buffer, in particular, may frequently be completely inadequate to protect wetlands from non-point source impacts, and provides a smaller separation distance than currently required for resource separation by other DEM programs (e.g., ISDS separation to water supply sources). Although it is proper for the Wetlands Section to consider an overall plan for a tract in evaluating impacts, no legal mechanism exists to allow the Section to review cumulative impacts.

The limitations on review of cumulative impacts are exacerbated by the fact that DEM jurisdiction in most wetland types is limited by the size of the resource. Jurisdiction extends to bogs of any size, but only to freshwater marshes an acre or more in size, ponds 1/4 acre or more in size, and wooded swamps exceeding three acres in area. Because these systems are dynamic, and respond to seasonal and climatic factors, boundary definitions artificially restrict consideration of system values, and serve to limit the broad "area of storm flowage" definition provided by the statute. Size threshold limits present particular problems when interconnected wetland resources are segmented by the classification scheme. For example, a marsh fringe around a pond may extend more than 50 feet from the open water of the pond, but be less than one acre in size, limiting DEM's jurisdiction over a potentially critical protective zone.

Further, individuals may currently purchase large tracts of land for development and divide ownership among alternating holding companies, each of which develops its holdings separately. Although the Wetland Section may be aware of interrelated ownership, no legal mechanism to condition permits based on cumulative impacts is available.

Issues Concerning Duration of Review Period

A number of important issues surround the sharing of review responsibilities among the state and federal agencies. EPA and the Corps of Engineers have expressed concern that projects eligible for federal level review under Section 404 of the Clean Water Act are unevenly referred to federal agencies having jurisdiction. Apparently a complete understanding has not been reached among the jurisdictions as to what projects are eligible for federal review under Section 404.

The Wetlands Section reviews applications prior to review by the ISDS Section or CRMC, and operates under a statutory 30 day response time limit once an applicant has submitted all necessary data for review. There is little time to complete a technical review, or to obtain comment from other state and federal agencies. With regard to CRMC, for example, integrated review between the two agencies can rarely be accomplished within the prescribed response time. At best, on determination request level applications, staff may be able to do no more than copy CRMC on response letters to the applicant, or consult with a CRMC biologist by telephone.

401 Water Quality Certifications, used by the Wetlands Section in conditioning permits, and required by the Corps prior to issuing permits, must be obtained from the DEM Division of Water Resources. The Division of Water Resources may not accept certification applications from applicants, but only from other agencies or administrative units within DEM. Because of the time required to undertake a reasonably effective technical review, both the Corps and the Wetlands Section are faced with a need to concentrate technical efforts in evaluation of the projects of greatest potential resource impact. Concerns regarding allocation of effort have arisen because of uncertainty as to the portion of review which the Corps can undertake prior to completion of a water quality certification.

The Wetlands Section does involve EPA evaluators in major highway and water resource projects, and in certain other controversial projects regarding site inspections or particular citizen complaints.

Sufficiency of Rules

Although "alteration" also includes the discharge of any effluent into a wetland, the rules and regulations currently in place consider most drainage system discharges as insignificant alterations. This particular regulatory interpretation of the statute hampers the Wetlands Section's ability to address stormwater runoff inputs to wetland areas.

Project Evaluation

In a statistical review of incomplete/inadequate permit applications to the Wetlands Section prepared for the Wetlands Task Force, the three most frequent areas of inadequacy were of critical concern in evaluation of non-

point source impacts: a) sediment and/or erosion controls inadequate or missing; b) contours missing or inadequate; c) wetlands delineation inadequate. The Task Force postulated three reasons for the chronic inadequacies in these areas, including attempts on the part of applicants to circumvent the regulations, poor understanding of regulatory requirements, and inadequate expertise drawn upon in delineating wetland areas.

Interviews with a developer confirmed that many developments affecting wetlands proceed outside the permit process. During the past year, delays in processing permits have been significantly reduced, so "avoidance of delay" now appears to be a less convincing motivation than a desire to circumvent the process.

Although such violations generally result in a sequence of violation notice, consent agreement, etc., applicants avoid the permit conditioning process, avoid implementing non-point source controls until the runoff and sedimentation damage has been done during construction, and may never be required to complete full restoration.

Sections 2-1-22 through 2-1-24 of the Freshwater Wetlands Act as amended in 1985 set out permit approval stipulations. In cases where developments affecting wetlands proceed outside the permit process, the Director of DEM is provided authority to order restoration work done by an agent, and to require reimbursement from the applicant. This authority is rarely utilized, partly because of its administrative complexity. If damage has occurred to wetlands owned by parties other than the developer or contractor charged with the violation, the Wetlands Section must cite all individual landowners, requesting the landowners' permission to allow a DEM contractor onto their property to conduct restoration work. Liability issues are frequently raised.

Similarly, Section 2-1-22 (f), states that "notice of permit and notice of completion of work subject to permit shall be eligible for recordation under Chapter 13 of title 34 and shall be recorded at the expense of the applicant in the land evidence records of the city/town where the property subject to permit is located, and any subsequent transferee of such property shall be responsible for complying with the terms and conditions of the permit."

This provision is extremely important, in that:

- a) public notice is provided in at least a limited manner;
- b) responsibility for maintenance of permit conditions is established, along with a mechanism for transfer of responsibility;
- c) a reference showing applicability of the wetland regulations is made available to building inspectors, so that compliance with specifications can be assured at the local level; and
- d) DEM can take action on property in which violations go uncorrected at the time of property transfer (in situations where the deed recordance interferes with an applicant's efforts to obtain a mortgage).

In fact, however, the notices are not consistently recorded. Although the Rhode Island Building Code references wetland permitting, no mechanism exists to ensure that building inspectors obtain the land evidence records and either verify recordation or assure compliance with stipulations before issuing building or occupancy permits. Because severe

non-point source pollutant impacts are associated with project construction, this program weakness is critical.

The issue of early pre-design conferences has been under discussion for some time, and was deliberated by the Task Force. Although formalization of the procedure could increase the adequacy of application design and reduce the overall time and cost per application for applicants and section staff, a number of important concerns remain. Increased staff involvement in pre-design discussion can tend to place inappropriate technical burdens on staff, rather than on applicants, who should bear design costs, including those involved in permitting. Internal documents have reiterated concerns that staff were being asked to become involved in the redesign of projects so as to enable applicants to avoid the full formal application process. Staff limitations would also tend to concentrate pre-design assistance efforts toward major projects, inevitably lessening resources available to review incremental effects of minor alterations. Finally, there is concern among staff that pre-design burdens tend to escalate as precedents of involvement are set.

On the other hand, several task force members were of the opinion that an applicant should be entitled to access regulatory opinions and input. Further, regulatory input must necessarily be distinct from any input provided by a professional consultant. The Wetlands Section now requires that applicants delineate wetlands on site maps, but the level of input which consulting wetlands biologists have in project design may be very limited. A separate avenue of recourse to technical assistance may be necessary.

Given the small size of the Wetlands Section staff and the fact that most permit applications are based on individual field investigations, the Section is very efficient in processing applications. The Wetlands Task Force reiterated that the staff has done an "outstanding job with the dollars available. "However, the Task Force and other observers close to the program have identified a number of areas in which staff has felt pressure:

- overweening emphasis on processing permits within the 30 day time limit (amounting to 20 working days) in spite of potential data limitations regarding evaluation of impact and determination of necessary permit conditions;
- emphasis on permit processing as taking priority over enforcement activity;
- emphasis on streamlining of permit applications (including movement toward office review, reliance on set decision criteria, standardization of analysis, and use of computer-generated permit conditions);
- emphasis on mapping as taking priority over enforcement activities; and
- enforcement of permit language as an *alternative* to stringent permit conditioning.

The inclusion of ephemeral wetlands and floodplain areas in the Freshwater Wetlands Act definition of wetlands, and the multi-faceted character of wetlands and wetland permits demands that staff time and resources be sufficient to exercise professional judgement regarding the complex dynamics of specific wetlands systems. Use of linear models is inappropriate in judging individual wetland character, interaction among related systems, and potential impacts of non-point source and other pollutants. The quality of the wetlands program is a function of the quality of enforcement, and enforcement can only be as effective as the language of the original permit

will allow. Therefore the quality of field work which supports permit language is extremely important, and must not be sacrificed to expediency.

A Task Force finding which was corroborated in interviews with staff and observers concerns intervention in the permitting process on the part of DEM administration. On recommending denial of certain projects, staff have been informed that the project "will go through," and have been advised to attach the permit conditions which they would professionally judge most able to mitigate impacts. Staff scientists have then attached the conditions, knowing full well they would not be implemented.

Intergovernmental Consistency and Enforcement

A number of town councils have policies which are in conflict with the Freshwater Wetlands Act. In some instances, town policies are established to ensure that roads are interconnected to facilitate movement of service and emergency vehicles and allow for efficient maintenance of infrastructure. In these communities, development of cul-de-sacs is discouraged or prohibited, and road or facility construction may be forced into wetland areas, even at increased expense to the developer.

In such situations, the Wetlands Section has no power to require that town policy be consistent with state requirements. Applicants tend to prefer going through the hearing and appeals process at DEM rather than obtaining a variance from multiple municipal bodies. In many towns, public works departments and municipal boards and commissions are insufficiently informed and/or unsympathetic regarding the objectives and regulatory requirements of the wetlands program.

Conflicts also arise with other state agencies regarding runoff and erosion control issues. Problems with DOT are complex, and have persisted over a number of years. Although the Wetlands Section maintains good working relations with DOT design personnel, who incorporate wetlands requirements into contract and design specifications, required practices are infrequently adhered to by DOT contractors.

Dumping of excess materials on adjacent property, including wetland areas, is a routine practice among DOT contractors, who frequently obtain permission to dump from abutters without regard to potential involvement of wetlands. Contractors consistently underbid projects, knowing that contract specifications cannot be effectively enforced. DOT places a resident engineer on the site of major projects, but resident engineers have not generally been willing to exert vigorous authority over contractors, and communication between the resident engineer and top DOT officials is insufficient.

Therefore, although DOT has the authority to withhold payment if a contractor fails to comply with contract stipulations, the control over disbursement can readily be circumvented at higher levels. DEM's Wetlands Section can issue cease and desist orders to a contractor for violations, but the orders apply only to areas over which the Section has jurisdiction. The contractor can continue to work elsewhere on the site, further limiting the utility of the threat of non-payment. Once a notice of violation has been served to a contractor, workload is such that weeks may pass before Section staff are able to follow up on the correction.

The Wetlands Section estimates that every DOT job involves at least six or more wetlands violations. When the Wetlands Section has approached DOT, a "sister agency," regarding violations, DOT has assured the Section that wetlands protection provisions were fully included in the contract and that the contractor should be considered in violation. DOT and the Wetlands Section, or the Wetlands Section alone, have thus far pursued violations through notice and citation procedures, which are subject to the limitations outlined above.

Under new Rhode Island provisions, administrative penalties may be assessed by one state agency against another. Although disagreements regarding salt storage have been negotiated historically, DEM could take enforcement action against DOT for actions taken by DOT contractors. DOT, as party to specific contracts, could initiate legal actions against contractors, as could the State Attorney General.

In an attempt to address these issues cooperatively, the Wetlands Section has informally volunteered to work with contractors and DOT resident engineers to delineate wetland areas. The Wetlands Section has recommended that DOT contractors obtain written permission from abutters to dump materials, informing abutters in writing that if wetland areas are involved, the abuttor must obtain a wetlands permit.

Staffing

The Wetlands Section has numerous responsibilities in overseeing the protection of Rhode Island's freshwater wetlands. The evaluation of permits to alter wetlands, and the issuance or denial of such permits, is a principle responsibility. Over 1000 permit applications were received in 1987. In addition to permitting, the Section is responsible for taking enforcement actions, including investigating complaints, sending warning letters, issuing notices of violation, and ordering restorations. Staff also provide guidance to applicants in such matters as revising plans to avoid wetlands or decrease significance of impacts, answer informational requests, hold pre-hearing conferences, attend formal hearings, and handle administrative duties.

Although DEM staff operate efficiently, staff limitations are such that insufficient resources are available for follow-up to ensure that permit conditions are met, and that applicants comply with permit conditions in the long term. The Section supervisor acknowledges that enforcement capability is insufficient to meet current needs, stating that "The backlog of enforcement actions is reaching crisis proportions, contributing to poor Section morale, lack of public confidence, and inadequate protection of the environment. Given the maintenance requirements of non-point source controls, lack of enforcement capability will create increasing program vulnerability as requirements for BMP installation are attached to wetlands permits.

Section personnel related a further concern related to enforcement. Because the Freshwater Wetlands Act regulatory language does not attach specific penalties to certain enforcement actions, necessary penalties and fines are less rigorously levied by management and/or administrators than they might be if penalties were strictly specified.

The use of staff technical personnel to undertake inspections and other field enforcement duties without the support of trained enforcement officers has been a subject of debate since the early 1970's. Although staff biologists involved with specific project applications are

most familiar with site characteristics and permit conditions, their technical capabilities and professional standing are best applied in a neutral implementation role.

Full implementation of non-point source control practices will require more than doubling the present engineering staff in the Wetlands Section, because of the need to undertake site-specific design and inspection surveys to ensure proper use of design criteria. Although the Wetlands Section welcomes standardization of design requirements between the Section and municipalities, the Section will be required to prove non-conformance with design specifications in order to take enforcement action against violators. The inspection process is expected to be labor intensive, and to very heavily involve engineering staff.

Because of the numerous responsibilities assigned to DEM legal staff, support of the Wetlands Section is less than optimal. The technical complexity of the wetlands delineations, and the role which technical issues play in jurisdictional issues, means that staff need to work closely with attorneys on a regular basis. Staff currently design and prepare consent agreements, which should also be verified by an attorney. Conversely, DEM attorneys arguing wetland issues in administrative hearings and judicial proceedings are completely dependent upon staff technical advisors in presenting and responding to technical questions. Staff support is not available to the degree necessary for all of the hearings in which DEM becomes involved. If legal staff were devoted to exclusive duty within the Wetlands Section, an interactive working understanding of technical issues could be developed which could support enforcement.

Recommendations to DEM

Jurisdiction and Project Evaluation

***In cooperation with other DEM Divisions and sections within the Division of Groundwater and Freshwater Wetlands, develop a new Water and Land Management Section within the Division of Water Resources which would assume a broad resource management role within the agency. The new administrative body would:

- coordinate results of all DEM monitoring and research programs;
- set up a data management system to be used by all DEM Divisions and to be coordinated with the recommended Technical Planning Sector at the Division of Planning;
- classify wetlands and other water bodies according to a resource value, scarcity, and vulnerability designation process;
- develop a framework allowing for significantly strengthened consideration of cumulative effects, as recommended in other sections;
- develop a water quality characterization process to be used to link biological integrity with effects of present use and potential use to the maximum extent possible. Waste load allocations and effluent limits should be established to coordinate the simultaneous imposition of point source discharge limits and non-point source controls;

- develop guidelines setting specific standards to govern the siting and design of development so as to consider water quality concerns as a basis for siting, operation, and maintenance;
- complete water quality certifications, developing guidelines and procedures as recommended in the subsequent section on water quality certification;
- utilize the 205j program's framework for setting need priorities to establish detailed water quality goals to guide non-point source pollution efforts in specific areas; develop a planning process for these selected areas which clearly links defined water quality goals to non-point pollution control programs and requirements;
- establish a pre-development and post-development water quality monitoring program for use in critical watershed areas and estuarine waters. Define how water quality measurements will be used in evaluating the adequacy of stormwater, erosion, and sedimentation control measures and facility designs. Define how water quality measures will be used in measuring adequacy of facility performance through time, and in initiating enforcement procedures where maintenance schedules are not adhered to and non-point source controls are allowed to become insufficiently effective; and
- as an aspect of the preceding responsibility, establish a two-part management oriented water quality standard in which each agency responsible for regulating activities with a potential for contaminating waterbodies would establish both a preventive action limit and an enforcement standard. The preventive action limit would be a small fraction of the companion enforcement standard; violation of this limit would trigger an examination of possible responses by the administrative body having jurisdiction over the source. Depending on the actual or potential seriousness of the contamination, the agency could require site-specific remedial action, revise agency rules to address the problem, or take no action. Violation of the enforcement would trigger an immediate enforcement action against the violator.

***Prepare revisions to statutory language providing DEM authority to:

- a) regulate alterations in wetlands of any size;
- b) specifically consider cumulative effects of wetland alteration.

**Revise wetlands regulations to provide an escalating scale of application fees for re-processing of deficient applications to account for increased staff review cost (presently applied in Dartmouth, Massachusetts).

***As discussed in DEM's Freshwater Wetland Conference Policy Statements, revise wetlands regulations to provide wetland definition encompassing areas as defined by the law in its broadest sense, based on the statements of intent in the Freshwater Wetlands Act.

*****Revise wetlands regulations to include clear policy statements and review criteria to be applied to proposed alterations to wetlands, regarding:**

- a) definition of wetland values to be used in designating wetland buffer areas (to include resource and habitat value, scarcity of the wetland resource type, rare and endangered species, potential cumulative effects, etc);
- b) definitions of applicable buffer area jurisdictions to be based on these values, *using a sliding scale from a minimum of* : 50 feet from the edge of a marsh, pond or bog; 100/200 feet of riverbank wetlands depending on the size of the watercourse; and 100 feet of an intermittent stream;
- c) definitions of applicable resource areas *affecting* buffers including areas: within 100 feet of the edge of a buffer surrounding a marsh, pond or bog; within 100/200 feet of a buffer surrounding a riverbank wetland (depending on the size of the watercourse); and within 100 feet of an intermittent stream buffer area (Massachusetts regulates areas influencing buffers and requires restoration of buffer areas affected by activities in these influencing areas);
- d) definitions of the term "minimal or no disturbance" to be allowed in such areas;
- e) specific means and methodologies to be used in deciding which applications will be subject to review of cumulative effects; what means and measurements will be used to evaluate cumulative effects; and what mitigating measures will be required. Criteria should include clear standards of evaluation regarding hydrologic modification, loadings of sediment/turbidity, and input of toxics which would facilitate evaluation of cumulative effects. (Such methodologies are currently applied in Maine, in Falmouth, Massachusetts, and in other jurisdictions.)
- f) specific technical issues to be considered in drawing distinctions between significant and insignificant alterations with regard to work that may affect the setback area of wetlands or may affect floodplains.

Technical criteria should include clear standards of evaluation regarding hydrologic modification, loadings of sediment/turbidity, and input of toxics which would facilitate classification of alterations and evaluation of cumulative effects.

****Revise wetland regulations to state specifically under what conditions floodplain analyses will be required, referencing: a) effect on potential floodplain areas; b) effect on existing watershed flood storage capability; c) effect on flood hazard vulnerability of surrounding development.**

****Identify and predesignate wetlands that protect priority waters from non-point source runoff under Section 404 (c) of the Clean Water Act.**

*****As recommended by the Wetlands Task Force, consider establishing an outside administration-level academic review board which could provide policy guidance, technical assistance to staff, and expert input to contested impact evaluations. For example, the review committee could provide written determinations where a staff biologist felt that a project was of a unique character not amenable to standard evaluation procedures, or raising issues not adequately addressed by**

existing written policy. For public projects involving funding deadlines or public projects involving health and safety issues, the review committee could meet with representatives of the public agency or municipality and the staff biologist to clarify issues, adjust project plans to mitigate wetland impacts, or set schedules and deadlines for compliance with specified pollution control measures or other impact mitigation procedures.

***As an adjunct to the review board recommended above, create an on-going Operations Committee to serve as a forum for public involvement, program review, and resolution of public concerns, using the wetlands task force as a basic model. Develop standing review committees to study and recommend solutions to particular substantive and administrative problems facing the freshwater wetlands program, and to which public concerns could be addressed, for administrative action. Provide funding sufficient to ensure publication and circulation of Operations Committee findings. (This committee would work closely with the Council advocated in Chapter 1.3.)**

Implementation of Non-point Source Controls

*****Revise wetlands regulations to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding stormwater management planning, design and installation of best management practices, and maintenance and repair of facilities. Attach applicable stormwater controls and maintenance and repair provisions to all wetlands permits.**

*****Revise wetlands regulations to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding erosion and sedimentation control, design and installation of best management practices, and maintenance and repair of facilities. These technical requirements will be defined in the updated Rhode Island Sediment and Erosion Control Handbook, currently in preparation. Attach applicable erosion and sedimentation controls and maintenance and repair provisions to all wetlands permits.**

*****Revise section 7.02 of the regulations, entitled "Drainage Effects;" to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding stormwater management planning, design and installation of best management practices, and maintenance and repair of facilities. Attach applicable stormwater and sedimentation controls to all wetlands permits.**

****Revise section 7.03 "Floodplains;" to define measures by which requirement of "zero displacement of flood storage capacity" can be formalized via performance and construction standards. Incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding stormwater, erosion, and sedimentation management planning, design and installation of best management practices, and maintenance and repair of facilities. Attach applicable stormwater, erosion, and sedimentation controls to all wetlands permits.**

****Revise section 7.03 to define criteria to be used in evaluating fill and excavation compensation plans with regard to potential stormwater and erosion/sedimentation impacts.**

Define performance and construction standards to be applied in fill and excavation compensation, and measures by which adequacy of measures will be evaluated.

*****Revise section 7.05 "Water Quality" to establish pre-development and post-development water quality monitoring authorization in freshwater wetlands and buffer areas.** Define how water quality measurements will be used in evaluating the adequacy of stormwater, erosion, and sedimentation control measures and facility designs. Define how water quality measures will be used in measuring adequacy of facility performance through time, and in initiating enforcement procedures where maintenance schedules are not adhered to and non-point source controls are allowed to become insufficiently effective.

Intergovernmental Consistency and Enforcement

****Revise the wetlands rules and regulations to specify enforcement actions and penalties which will result from various violations.**

*****Develop an outreach program in cooperation with CRMC and the Division of Planning to reach consistency between local construction, public works, safety, and other local policy provisions, and provisions of the Freshwater Wetlands Act and related resource protection statutes.**

*****In cooperation with DOT, and the Attorney General's Office, establish a team of contract consistency reviewers to undertake frequent on-site review and monitoring of DOT contractor compliance with contract specifications for control of non-point source pollution and other activities potentially degrading wetland resources.** The review team could be supported using monies from a revolving fund for enforcement made up of performance bond monies collected from contractors, and administrative penalties collected from contractors or municipal or state agencies found in violation of program provisions.

****In cooperation with other DEM program offices, CRMC, the Division of Planning and the Attorney General, formulate an administrative mechanism by which town officials can be effectively involved in enforcement of compliance with permit requirements.** Provisions and requirements of the Freshwater Wetlands Act need to be specifically referenced in individual town building codes.

****Work with towns to ensure that Section 2-1-22 (f) of the freshwater wetlands regulations is enforced.** This section, as described previously, states that "notice of permit and notice of completion of work subject to permit shall be eligible for recordation under Chapter 13 of title 34 and shall be recorded at the expense of the applicant in the land evidence records of the city/town where the property subject to permit is located, and any subsequent transferee of such property shall be responsible for complying with the terms and conditions of the permit. "In that regard, ensure that the applicable town, and the town conservation commission, is notified of wetland applications received, and subsequent permit conditions attached.

****Establish a local enforcement and review fee to be required of all permit applicants.** The fee required should be commensurate with the size of the project and with potential watershed impact. The funds collected should be passed through to the town in question to support hiring of local officials responsible for review of state wetlands and other

environmental permit requirements. Pass-through of funds would be contingent on Wetlands Section spot-checks of permit compliance consistency among town land evidence records, state permit requirements, and evidence in the field.

****In permits, ensure that responsibility for maintenance of permit conditions is established, along with a clear mechanism for transfer of responsibility at the time of a change in ownership.**

*****In cooperation with the State Building Commissioner, develop an administrative mechanism to ensure that building inspectors or other town officials (such as environmental officers) obtain the land evidence records on all relevant properties to verify that wetlands permit application data is fully recorded. Develop a permit bonding fee or other legal mechanism to make the inspector or the town in question liable for assuring compliance with stipulations before a building or occupancy permit is issued. Because severe non-point pollutant impacts are associated with project construction, this program linkage is crucial.**

****Expand the practice of taking action on properties in which violations go uncorrected. Ensure that land evidence records are not tampered with during periods of anticipated property transfer.**

Staffing

****Hire additional staff as necessary to allow the Section to:**

- a) issue cease and desist orders wherever unpermitted actions have the potential to degrade the environment and wherever permit conditions are not being complied with;
- b) make timely site visits to ensure compliance with orders;
- c) issue timely notices of violation if orders are not complied with;
- d) refer violations for timely legal action if necessary.

*Consider separating staff implementation and enforcement roles. A number of potential approaches could be considered. A team of staff biologists might be dedicated specifically to responding to complaints and testifying as expert witnesses in violation cases. These staff members could coordinate with permit review staff as necessary. Alternatively, conservation officers or other enforcement personnel could be trained to serve cease and desist orders and to follow up on compliance. CRMC's experience with shellfish enforcement officers could be drawn upon in the latter case.

Recommendations to DOT

****In cooperation with the state Attorney General's Office, standardize contract stipulations so as to penalize contractors not adhering to design specifications, such as those regarding installation and maintenance of soil erosion and sediment control practices.**

*****In cooperation with the state Attorney General's Office, develop a contract bid review procedure which escalates performance bonding requirements based on past conformance with contract provisions relating**

to water quality protection and wetlands resource protection. Require that performance bonds be included in overall bid assessment.

*****In cooperation with DEM and the Attorney General's Office, establish a team of contract consistency reviewers to undertake frequent on-site review and monitoring of DOT contractor compliance with contract specifications for control of non-point pollution and other activities potentially degrading wetland resources. The review team should be administratively part of the technical staff of the Attorney General's office. The team could be supported using monies from a revolving fund for enforcement made up of performance bond monies collected from contractors, and administrative penalties collected from contractors or municipal or state agencies found in violation of program provisions.**

****Establish a policy regarding 3R projects requiring mandatory evaluation of impacts of roadway drainage on adjacent water quality. Require the retrofit of drainage structures to minimize water quality impacts.**

Recommendations to the Office of the Attorney General

*****With the assistance of a technical advisory committee, undertake a comprehensive review of state and federal highway construction safety and engineering requirements to identify all inconsistencies between those provisions and the recommendations of the Stormwater and Erosion Control Committee regarding non-point source pollution control practices.**

*****Investigate to what extent federal requirements limit use of federal highway funds or use of matching funds in construction or maintenance of non-point pollution control practices or facilities. Similarly, investigate to what extent federal requirements limit use of federal highway funds or use of matching funds in retrofitting highways to consider non-point pollution control needs.**

****Make recommendations as to how DOT may interpret federal requirements in their broadest possible light with regard to its ability to address non-point source controls. Investigate the roles which the federal consistency requirements of the Coastal Zone Management Act and the National Environmental Policy Act may play in eliminating potential conflicts.**

Recommendations to the Department of Business Regulation, Real Estate Division

****Amend regulations to forbid the use of a waiver provision to inform prospective property buyers regarding the existence of wetland areas on properties. The use of a blanket waiver stating that wetland areas lie on "all or part" of a property subverts the intent of the notification provision, and restricts a prospective buyer's ability to make informed decisions. Require that sellers or real estate representatives inform prospective buyers as to the realistic possibility of wetland area property coverage based on the technical advice of a consultant, or inform buyers as to the need to obtain technical advice from a qualified consultant.**

****Require that sellers of property and/or real estate representatives inform prospective buyers as to zoning ordinances, subdivision regulations, building code specifications, and any other regulatory measures, which, because of the exposure of the property to a natural hazard, could influence decisions made by potential buyers.**

****With the assistance of DEM, CRMC, and the Division of Planning, develop and implement a program to investigate loan practices which discourage environmentally sound land use management and penalize institutions which fail to encourage water quality protection.**

DEM WATER QUALITY CERTIFICATION

Findings and Concerns

Under the authority of Section 401 of the Clean Water Act, DEM issues water quality certifications which are designed to ensure that all state permits sufficiently provide for compliance with applicable water use designations. A staff scientist in the Division of Water Resources is responsible for reviewing all formal applications for freshwater wetland permits, all CRMC category B assents, and for providing input in the Coordinative Review process.

Water quality certifications routinely set erosion control standards for upland projects where soil disturbance is anticipated and specify drainage control standards where outfalls may create scour or other erosive effects. Installation of silt curtains and other erosion control measures are frequently required in subdivision developments and other large scale alterations. Certifications become components of CRMC assents and freshwater wetland permits, and any certification stipulations are included as conditions.

Although the certification process is used as a principal water quality and wetland protection tool in many states, it has not been developed as a key regulatory tool in Rhode Island. One staff scientist is devoted half time to the tasks of reviewing all certifications and developing policy. DEM is considering hiring a full-time staff scientist to handle all aspects of certifications, but action has not yet been taken.

No written guidance has been prepared to specify how performance standards and conditions should be placed on permits, although the clear need for such guidance was articulated by staff in February 1987. Currently, performance standards relating to non-point source control are developed informally with guidance and input from available DEM staff engineers and water quality planners. The enforcement of stipulations included in the certifications fall to the agency or section issuing the permit.

Recommendations

*****Develop specific written guidance establishing evaluation criteria and technical decision methodologies to be used in preparing water quality certifications. Develop specific written guidance setting out procedures for establishing permit conditions based on performance standards *and* construction standards. Ensure that guidance and procedures are consistent with the objectives of the Stormwater and Erosion Control Committee regarding stormwater and**

sediment management planning, design and installation of best management practices, and maintenance and repair of facilities.

*****Revise certification procedure to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding stormwater management planning, design and installation of best management practices, and maintenance and repair of facilities.** In coordination with the principal permitting agency or section, ensure that applicable stormwater controls and maintenance and repair provisions which are attached as permit conditions sufficiently address the goals of water quality certification.

*****Revise certification procedure to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding erosion and sedimentation control, design and installation of best management practices, and maintenance and repair of facilities.** These technical requirements will be defined in the updated Rhode Island Sediment and Erosion Control Handbook, currently in press. In coordination with the principal permitting agency or section, ensure that applicable erosion and sedimentation controls and maintenance and repair provisions which are attached as permit conditions sufficiently address the goals of water quality certification.

****As a joint effort of applicable DEM Divisions and CRMC, establish a pre-development and post-development water quality monitoring program for use in critical watershed areas and estuarine waters.** Define how water quality measurements will be used in evaluating the adequacy of stormwater, erosion, and sedimentation control measures and facility designs. Define how water quality measures will be used in measuring adequacy of facility performance through time, and in initiating enforcement procedures where maintenance schedules are not adhered to and non-point source controls are allowed to become insufficiently effective.

*****Hire additional staff as necessary to allow the Division of Water Resources to:**

- a) develop policy and prepare necessary technical guidance;
- b) review applications and prepare water quality certifications with full attention to the technical recommendations and stipulations set out by the Stormwater and Erosion Control Committee regarding erosion and sedimentation control, design and installation of best management practices, and maintenance and repair of facilities;
- c) make site visits with permit enforcement personnel to ensure compliance with permit specifications;
- d) participate fully in the Coordinative Review process, including attending meetings with agency staff and applicants.

DEM PERMITTING UNDER RIPDES

Findings and Concerns

If urban runoff is channeled into a sewage or storm drain system, or into a stream network or other receiving waters, it becomes a significant source of pollution, as outlined

in introductory sections of this chapter. For this reason, EPA has required that the NPDES permit system must be applied to urban runoff in the late 1980s. Rhode Island's RIPDES program, and the point source discharge programs of Massachusetts, will be required to follow suit.

Both state regulators and municipal public works agencies are much concerned by the advent of this new responsibility, and many questions regarding implementation remain. Because treatment technology for stormwater per se is still experimental, it is unclear whether treatment of the runoff effluent will be required by EPA. Municipalities are concerned that the expenses of stormwater treatment requirements would rival those of secondary sewage treatment. In Rhode Island, given the spotty enforcement history of the RIPDES program (U.S.EPA, 1987) stormwater discharge permitting is likely to raise very difficult issues.

Recommendations

In issuing development permits throughout DEM and CRMC, and in coordinating implementation efforts with other state agencies, place strong emphasis on preventing stormwater discharge rather than curing its effects. In that regard, increase emphasis on source control, on management of household hazardous waste and on strict adherence to required stormwater management practice.

Consider issuing general permits to urbanized or urbanizing watershed areas rather than to specific cities or towns. Towns could then establish stormwater utilities singly or jointly and could set rates for stormwater services, and organize management, on a watershed basis. The Ten Mile, Pawtuxet, and Pawcatuck Rivers could be used as prototypes to evaluate the feasibility of issuing general permits where toxics-based NPDES and RIPDES permits have been issued.

DEM MANAGEMENT OF WASTE OIL THROUGH THE OCEAN STATE CLEANUP AND RECYCLING PROGRAM

Waste lubricating oil is disposed of in various ways by the 35 percent of Providence residents who change their own automobile lubricating oil (Hoffman, et al., 1980). Methods included garbage can disposal (41 percent), backyard dumping (30 percent), disposal down sewers or storm drains (8 percent), return to a service station (7 percent), pouring the oil on the road (5 percent), and disposal at the town dump (3 percent).

On a weight basis, road or sewer disposal can account for 44 metric tons of hydrocarbons discharged into the city's combined storm and sanitary sewage treatment system, or 19 percent to the total hydrocarbons discharged by the city plant. Disposal on land, or in dumps (directly or via solid waste collection) also contributes to deterioration of Bay water quality, due to contamination of land runoff, urban runoff, and groundwater, although inputs due to these sources are difficult to measure (Hoffman et al., 1980).

Throughout the state, 1980 estimates indicate that roughly 700,000 gallons of used industrial oil and over 2 million gallons of used automotive oil are produced annually. Because waste oil is classified as a hazardous waste according to the Hazardous Waste Management Act of 1978, state regulations specify that it must be manifested on disposal. 371,703 gallons were manifested in 1985, a figure which DEM's Ocean State Cleanup and

Recycling Program (OSCAR) considers to be very conservative. OSCAR estimates that 92 percent of used automotive oil is discarded in "an unacceptable and often illegal manner.

In 1980, the Rhode Island Legislative Commission on Used Oil attempted to quantify direct economic costs associated with loss of used oil. The Commission estimated that between .57 and 1.64 million gallons of potentially recyclable used oil was being discarded annually in the state. Estimated value of the oil before treatment (@ \$0.10 per gallon) was \$60,000 to \$160,000. After treatment, the lost oil was valued at an estimated \$180,000 to \$480,000 (@0.30 per gallon.) DEM program start-up cost was \$6000.

On the basis of the Commission's economic findings and in response to growing environmental concerns, the Assembly passed waste oil recycling legislation in 1980, authorizing DEM to set up a voluntary program. By summer of the same year, DEM had recruited 73 service stations to participate in the program, and the number continued to grow during the next year. Service stations re-sold the waste oil to used oil concerns, which marketed the refined product as fuel oil. High energy prices created a significant demand for the recycled material through the mid-1980s.

Market conditions, however, drastically affected the operation of the program, as collapsed energy prices eliminated the market for the recycled product. Service stations could no longer sell the waste oil, and dropped out of the program. Currently, only a few stations take waste oil, and those charge customers for disposal. The Solid Waste Management Corporation operates a free drop-off at the Central Landfill in Johnston.

Waste oil disposal is regulated under the hazardous waste statute (RIGL Chapter 23-19.6), the Water Quality Act (Chapter 12 of Title 46), and the Air Quality Act (Chapter 23 of Title 23). The hazardous waste regulations specify that used oil must be "collected and recycled to the maximum extent possible."

Rhode Island is presently revising its statewide solid waste management plan to address the waste oil issue, among other concerns. The Department's proposed waste oil recycling program will provide a collection center (igloo) in each of the state's 39 cities and towns, a grant for site preparation, and collection service for the first year. Installation, maintenance, and security will be the community's responsibility.

DEM also proposes to implement a curbside collection pilot project in one community. DEM will provide residents with containers in which oil can be left at the curb along with other recyclables. Records will be kept to document the total amount of oil collected, and the source of the oil, for comparison with a similar community using the igloo system without curbside collection. DEM will consider expanding the curbside collection program if it generates substantially more oil than the igloos.

Recommendations

Although the igloo system represents a step in the right direction, curbside collection offers many advantages. Igloos may be subject to vandalism, and require monitoring to guard against illegal deposit of solvents and other contaminants. After the first year, the towns must contract for regular collection, transportation, and recycling of the oil by a licensed waste hauler. Particularly if biweekly disposal is required, the actual fate of the oil may be much less certain, and less easily monitored, than with larger state contracts.

Further, survey results have indicated that convenience is a key factor in encouraging recycling (Hoffman et al., 1980).

In view of these considerations, every effort should be made to make the curbside collection program successful, to make it as cost-effective as possible, and to publicize results. Calculations of cost-effectiveness should consider the benefits of preventive action in lowering groundwater clean-up expenditures.

ROLE OF THE RHODE ISLAND CONSERVATION DISTRICTS

(See also 2.2 Agriculture-Related Sources)

Findings and Concerns

Conservation Districts are local units of government organized by local residents under state law. The Rhode Island Conservation Districts follow county boundaries. Under the Rhode Island State Conservation Law, each District is responsible for soil and water conservation work within its boundaries. District governing board members are locally elected or appointed by the State Conservation Committee. Governing boards plan and carry out long-range programs and provide guidance to the SCS regarding local needs and priorities. At the request of the district board, SCS assigns a district conservationist and a staff to provide technical assistance to the district and its cooperating land user "clientele." Each District responds to the needs of its user clientele in setting program objectives.

The Rhode Island State Conservation Law assigns a broad mission to Conservation Districts, giving these bodies considerable responsibility to address stormwater management and erosion and sediment control. (The statutory language defining powers of Districts and directors is provided in full in the related chapter on agricultural non-point sources.)

The Conservation Districts in the Bay basin provide critical institutional linkages and perform numerous important functions in non-point source control. Districts work closely with SCS and ASCS in providing assistance to farm operators in developing soil erosion control and agricultural waste management plans. Municipalities have become strongly dependent on the districts, relying on district technical assistance in review of site development plans and other implementation efforts. Districts also provide assistance in the review of Environmental Impact Statements and non-point source control plans developed for proposed state and federal projects in the district, including highway projects.

The demands being placed on the districts are changing with urbanization, as loss of working farmland, and increased municipal emphasis on control of development impacts have required the districts to broaden the emphasis of their efforts. In Rhode Island, the three Conservation Districts place varying degrees of emphasis on particular functions, based on the conservation needs in the district. In the face of burgeoning development in Newport County, the Eastern District is moving to address the environmental problems of an urbanizing landscape. The District has assumed an important role in helping towns protect water supplies, and places strong emphasis on groundwater and watershed protection (including erosion control and stormwater runoff management) in addition to agricultural resource protection.

The ERICD board and the District Conservationist (an SCS employee) have developed an advocacy role with client towns, familiarizing town boards with the need for stormwater and sediment control programs, and making them aware of the services available from the District. As the towns have recognized the broad value of District technical assistance, they have increasingly called on the Conservationist and the board.

The Conservationist reviews all stormwater management site plans prepared to meet the requirements of Middletown's drainage control ordinance, which stipulates no increase in discharge. As in other areas of the state, none of the Newport County towns have a municipal employee dedicated to the task of implementing stormwater management and sediment/erosion control programs. If the District had a technical staff, it could also offer Middletown (and other district towns) assistance in enforcement, supplementing the efforts of buildings inspectors who generally have little or no experience with urban best management practices (BMPs).

In states where non-point source programs have been put in place, compliance levels have been directly correlated with inspection frequency. This is particularly true when available municipal staff resources are inadequate to ensure regular, timely inspection of installation and maintenance routines. Currently, Conservation District board members are rarely able to visit individual urban BMP sites, and District Conservationists, who are SCS employees, are prohibited by law from engaging in enforcement activities. Thus, unless District or municipal staffing capability is increased, proper maintenance is expected to become an increasing concern. The Eastern District is working with towns in the County to set up a one year pilot program in which program development assistance would be made available to towns on a fee basis.

The Northern District places its greatest emphasis on farm conservation practices and needs, although certain towns have signed memoranda of understanding (MOUs) with the District under which the District Conservationist reviews erosion and sediment control plans. Because the swiftly developing Northern District includes the Scituate Watershed, where non-point source pollution control initiatives are being tested, the District Board's willingness to place increasing emphasis on urban BMPs is extremely important. In this area in particular, a concerted outreach program will be needed in order to make town boards aware of the technical assistance available through the District, and its utility in a range of contexts. The Northern District has set a goal to have Memoranda of Understanding (MOUs) regarding review of plans and permits in place with all district towns by 1991.

The Southern District is midway between the Eastern and Northern Districts in its emphasis. Its District Conservationist is new in his position, but brings considerable non-point source management experience to the job. In the Southern District, as elsewhere, District Conservationists and boards are regularly called upon to provide assistance in interpreting state regulatory requirements, particularly with regard to the freshwater wetlands program. Districts also aid towns in obtaining technical project evaluation assistance through the Resource Conservation and Development Council, and advise them in defining land acquisition objectives.

The Districts play an extremely important role in community education, which will be pivotal in development of a successful non-point source program. Their quasi-governmental advisory role, flexible mandate, and mission to respond to the needs of client

groups place the Districts in a unique position. Districts can conduct workshops and prepare handbooks and educational materials which are targeted to the needs of specific towns and discrete problem areas. In addition, they can exert influence in ways that are not open to state regulatory agencies. For example, not only may the Districts lend valuable assistance, they may also place their limited resources in the service of towns where their advice is adhered to, providing a potentially powerful incentive for follow-through once ordinances have been enacted.

In many states, Districts are well-funded and serve as the key local focus for major programs. In Rhode Island, by contrast, Conservation Districts are funded at an extremely low level by the state. Each District normally receives one to two thousand dollars annually from appropriations to DEM. For the upcoming fiscal year, no funds have been made available, as all such funds have been pooled to support the hiring of a part-time staff person to promote use of the state's erosion and sedimentation enabling legislation in all of the towns in the state.

Conservation Districts conduct annual seedling sales to generate funding, and solicit funding from municipalities to which they provide technical assistance. Occasionally, workshop revenues exceed costs, contributing minimal supplemental funding.

District funding is completely inadequate to meet increasing, and increasingly diverse, demands. The Eastern District, for example, solicits roughly \$2000 total per year from municipalities to which it provides technical assistance, and is working with those towns to develop methods to solicit grant funds from other sources. The other Districts receive even less municipal funding. Given the importance of district activities, funding must be increased.

Districts presently have no staff, other than part-time secretarial support. District Conservationists, who are SCS employees assigned to serve district needs, meet most of the requests which come to the districts. Since the formulation of the AWQMP, Rhode Island has placed considerable reliance on the Districts, and plans to expand their role in upcoming implementation of broader non-point source controls. Rhode Island must increase district staff if new responsibilities are to be met.

Recommendations to RIDEM/R.I. Dept. of Revenue

*****Provide on-going funding for Conservation Districts which is sufficient to enable the districts to inventory sources, provide technical assistance to farmers, monitor BMP maintenance and effectiveness, and implement other programs as necessary to meet their responsibilities in ensuring effective control of agriculture-related non-point source pollution.**

Recommendations to Conservation Districts

****In cooperation with the Division of Planning and the USDA Resource Conservation and Development Program, complete an inventory of existing municipal controls relating to sediment and erosion control, runoff and drainage management, floodplain management, aquifer protection, open space protection, and critical area protection.**

*****Work with municipalities to encourage development of land use management programs in critical Basin watersheds to improve water**

quality. Consider creating a permanent staff position (in each District) to work on a rotating basis with towns to assist in developing land use management capabilities, promoting enactment of stormwater management and erosion/sediment control programs, informing town officials as to the purpose and content of state regulatory programs, setting land acquisition priorities, and other related functions.

*****Work with towns to promote installation of stormwater and erosion controls in all watersheds within District jurisdiction, giving priority to those in critical areas or creating significant adverse impacts.** In cooperation with other districts, develop district-specific and statewide research agendas to address specific impediments to installation of BMPs.

*****Expand district staff to meet the rapidly increasing demand in all districts for technical assistance, program review, education programming, and enforcement assistance.** At a minimum, a full time staff employee should be available in each district to perform each of the following functions:

- assist municipalities in development and implementation of erosion and sedimentation control programs;
- assist municipalities in development and implementation of runoff control programs;
- assist towns in inspection of stormwater management and erosion control facilities, and in enforcement of applicable local ordinances;
- develop educational materials and promote control of non-point source pollution;
- develop educational materials and work with Cooperative Extension Service County Agents, garden clubs, and other organizations to promote control of non-point source pollution resulting from home use of fertilizers, pesticides, and other household chemicals;

****Expand staff to ensure that technically qualified individuals are available to undertake "outreach" activities necessary to ensure successful implementation of the range of stormwater management and erosion control initiatives undertaken by client towns.** Outreach will involve regular attendance/participation in meetings of town councils, planning boards, zoning boards, public work and engineering departments, conservation commissions, other town commissions, citizens groups, etc.

CRMC RESPONSIBILITIES UNDER THE COASTAL RESOURCES MANAGEMENT PROGRAM

(see also Chapter 3.1, Management of Coastal Land and Water Uses: the Role of CRMC)

Findings and Concerns

Section 300.2 and 300.3 of the Red Book give CRMC has broad authority to establish permit conditions so as to require management of stormwater and emplacement of erosion and sedimentation controls. Section 300.2 B prohibits filling, removing, or grading on "beaches, dunes undeveloped barrier beaches, coastal wetlands, cliffs and banks, and

rocky shores adjacent to Type 1 and 2 waters unless the primary purpose of the alteration is to preserve or enhance the feature as a conservation area or natural buffer against storms."

Similarly, filling, removing or grading is prohibited adjacent to Type 1 and 2 waters and in coastal wetlands designated for preservation adjacent to Type 3,4, and 5 waters unless as a consequence of an approved mosquito-control ditching project.

A potentially important tool in control of urban runoff contamination and pollution of shorefront waters is provided by the requirement that all bulk-oil transfers involving ships and facilities require a permit from CRMC.

CRMC addresses stormwater management and erosion and sediment control in more detail in specific SAM plans. (See detail of the Narrow SAM plan regulatory language in Appendix 2.3). Plans outline management policies and regulations relating to stormwater control, require development of stormwater management plans as part of the permitting process, and set criteria for performance and design standards to be applied, citing specific publications as design references.

Stormwater management is defined as relating to both quantitative and qualitative control. For quantitative control, stormwater management refers to a "system of vegetative and structural measures that control the increased volume and rate of surface water runoff caused by man-made changes to the land;" for qualitative control, vegetative, structural, and other measures are designed to "reduce or eliminate pollutants that might otherwise be carried off by surface runoff."

Remedial stormwater management activities are addressed in a more general way in the SAM plans. Section 320.2 F. of the Narrow River SAM plan, for example, defines remedial actions as those which are taken to address a situation where no stormwater management presently exists and there is a clear threat to water quality which the proposed activity addresses. Part F 2) provides for the granting of Special Exceptions, under the requirements of Section 130 of the CRMP, for new or expanded discharges of stormwater.

The section states that CRMC "shall give strict consideration to paragraphs A(2) and A (3) of Section 130, which stipulate that all reasonable steps shall be taken to minimize the environmental impacts and/or use conflicts, and that there is no reasonable alternative means of, or location for serving the compelling public purpose cited."

Further, Section 320.2 G recommends that CRMC, DEM, and the towns undertake a cooperative program to upgrade existing direct discharges which do not employ, or possess substandard, stormwater management techniques and are discharging into the (Narrow River) and its tributaries and wetlands, integrating the standards and design techniques presently being evaluated by DEM. Recommendations for further scientific and technical research and demonstration projects are also included.

CRMC staff limitations are such that insufficient resources are available for follow-up to ensure that permit conditions are met, and that applicants comply with permit conditions in the long term. Given the maintenance requirements of non-point source controls, lack of enforcement capability will create increasing program vulnerability as requirements for BMP installation are attached to permits. The Executive Director acknowledges that enforcement capability is inadequate to meet current needs.

Trained enforcement officers on the CRMC staff need to be available to undertake inspections and other field enforcement duties. Use of technical personnel in this capacity without the support of officers has long been a subject of debate with DEM wetlands enforcement, and reliance on technical personnel should be avoided. Although staff biologists and engineers involved with specific project applications are most familiar with site characteristics and permit conditions, their technical capabilities and professional standing are best applied in a neutral implementation role.

Full implementation of non-point source control practices will require more than doubling the present engineering staff of CRMC, because of the need to undertake site-specific design and inspection surveys to ensure proper use of design criteria. Although the Wetlands Section welcomes standardization of design requirements between the Section and municipalities, the Section will be required to prove non-conformance with design specifications in order to take enforcement action against violators. The inspection process is expected to be labor intensive, and to very heavily involve engineering staff.

Recommendations to CRMC

(See also other sections of Part 2, and Chapter 3.1)

*****Revise CRMC regulations to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding stormwater management planning, design and installation of best management practices, and maintenance and repair of facilities.** Attach applicable stormwater controls and maintenance and repair provisions to all CRMC permits.

*****Revise CRMC regulations to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding erosion and sedimentation control, design and installation of best management practices, and maintenance and repair of facilities.** These technical requirements will be defined in the updated Rhode Island Sediment and Erosion Control Handbook, currently in press. Attach applicable erosion and sedimentation controls and maintenance and repair provisions to all CRMC permits.

*****In permits, ensure that responsibility for maintenance of permit conditions is established, along with a clear mechanism for transfer of responsibility at the time of a change in ownership.**

****Providing that currently proposed and recommended legislation providing for land evidence record permit attachment is acted upon, work with the State Building Commissioner to improve local permit enforcement.** Develop an administrative mechanism to ensure that building inspectors or other town officials (such as environmental officers) obtain the land evidence records on all relevant properties to verify that CRMC permit application data is fully recorded. Develop a permit bonding fee or other legal mechanism to make the inspector or the town in question liable for assuring compliance with stipulations before a building or occupancy permit is issued.

Because severe non-point pollutant impacts are associated with project construction, this program linkage is crucial.

****Establish a town enforcement and review fee to be required of all permit applicants in addition to currently levied application fees.** The fee required should be commensurate with the size of the project and with potential watershed impact. The funds collected should be passed through to the town in question to support hiring of local officials responsible for review of state wetlands and other environmental permit requirements. Pass-through of funds would be contingent on spot-checks of permit compliance consistency among town land evidence records, state permit requirements, and evidence in the field.

Appendix 2.3

Applicable CRMC Regulations under the Narrow River SAM Plan

Section 320.2 of the Narrow River SAM Plan , part A. 2, states "It shall be the policy of the CRMC to require proper stormwater management within the Narrow River watershed for the following activities:

- 1) New residential developments of six units or more;
- 2) Facilities or activities requiring or creating 20,000 square feet or more of total impermeable surface area, or resulting in twenty percent or more of the project being rendered impervious;
- 3) All roadway construction and upgrading projects;
- 4) Any activity within the watershed involving any maintenance, alteration, use or improvement to an existing stormwater management structure changing or affecting the quality, rate, volume, or location of surface water discharge;

Part B of 320.2 requires project proponents to submit project stormwater management plans to CRMC. Detailed guidelines set out applicant responsibilities as well as information requirements which must be met in submission of plans. The language is specific, and selections are presented here:

320.2 B Guidelines for the Stormwater Management Plan

1. It is the responsibility of the applicant to submit a Stormwater Management Plan containing sufficient information for the CRMC to evaluate the environmental characteristics of the affected areas, the potential and predicted impacts of the proposed activity of the Narrow River and its tributaries, and the effectiveness and acceptability of those measures proposed by the applicant for reducing adverse impacts. The Stormwater Management Plan shall contain maps, charts, graphs, tables, photographs, narrative descriptions and explanations, and citations to supporting references, as appropriate to communicate the information required by this section.

Detailed descriptions of existing environmental and hydrologic conditions on the site, and in receiving waters and wetlands must be submitted, including:

- a) The direction, flow rate, and volume of surface runoff under existing conditions and to the extent practicable, predevelopment conditions; the required information shall be based on the 1 year, 10 year, and 100 year storms for the 24 hour duration, and the duration which coincides with the time of concentration of the water shed;
- b) The location of areas of the site where stormwater collects or percolates into the ground;
- c) A description of all surface watercourses, water bodies, and wetlands on or entering a site, or adjacent to the site, or into which stormwater flows. Information regarding their water quality and the current water quality classification given them by the DEM shall be included;

- d) Depth to seasonal groundwater levels, approximate direction and rate of flow, seasonal fluctuations;
- e) Location of 100 year flood zones;
- f) Principal vegetation types;
- g) Topography described in full contour detail, at 2 foot intervals, with areas of steep slopes (over 10%) highlighted;
- h) Soils, with an accompanying analysis of the best use potential of the soils and the hydrologic group classification; the soils map and use analysis prepared by the US Soil Conservation Service should be used as the basis for this analysis.

Proposed alterations of the site must be described in detail, as follows, including:

- a) Changes in topography, described in full contour details at 2 foot intervals;
- b) Areas where vegetation will be cleared or otherwise altered;
- c) Areas that will be covered with an impervious surface and a description of the surfacing material;
- d) The proposed development layout including;
 - i) The site arrangement, including the location of structures, roadways, parking areas, sewage disposal facilities, and undisturbed lands.
 - ii) All drainage systems to be provided, including the location and design of roadway and individual lot sub-drains; full drainage calculations shall be included, with 1 or 2 year, 10 year, and 100 year storms used as the basis of design.

Predicted impacts of the proposed development on existing conditions must be described in detail, including:

- a) Changes in water quality;
- b) Changes in groundwater levels;
- c) Changes in the incidence and duration of flooding on the site and upstream and downstream from it;
- d) Adverse impacts on wetlands;
- e) Impacts on vegetation;

Drainage system components and all measures for the detention, retention, or infiltration of water or for the protection of water quality must be described in detail, including:

- a) The channel, direction, volume, and rate of the flow (CFS), and quality of stormwater that will be conveyed from the site, with a comparison to existing condition, and to the extent practicable, predevelopment conditions;
- b) Detention and retention areas and devices, including;

- i) Plans for the discharge of contained waters; including the time to draw down from full condition, description of outlet structures;
 - ii) Maintenance plans; including maintenance schedule, an outline of responsible parties and all pertinent agreements to be executed to insure proper maintenance;
 - ii) An evaluation of the pollutant removal efficiency of such devices under the existing conditions;
- c) Areas of the site to be used or reserved for percolation including the depth to seasonal groundwater table, and prediction of the impact on groundwater quality;
 - d) Areas to be utilized in overland flow, the hydrologic soil type of such areas, vegetation present, and the soil susceptibility to erosion;
 - e) Any other information which the developer or the CRMC believes is reasonably necessary for an evaluation of the development.

Submitted Stormwater Management Plans must demonstrate that the proposed development or activity has been planned and designed and will be constructed and maintained to meet each of the following standards (Section 320.2 C):

1. Ensure that after development, runoff from the site or activity approximates the rate of flow, volume, and timing of runoff that would have occurred following the same rainfall conditions under existing conditions and, to the extent practicable, pre-development conditions;
2. Maintain the natural hydrodynamic characteristics of the watershed;
3. Protect or improve the quality of surface and groundwaters;
4. Protect groundwater levels;
5. Protect the beneficial functioning of wetlands as areas for the natural storage of flood waters, the chemical reduction and assimilation of pollutants, and wildlife and fisheries habitat;
6. Prevent increased flooding and damage that results from improper location, construction, and design of structures;
7. Prevent or reverse salt water intrusion;
8. Protect the natural fluctuating levels of salinity in estuarine areas;
9. Minimize alteration to flora and fauna and adverse impacts to fish and wildlife habitat;
10. Otherwise further the objectives of the SAM plan.

In order to ensure attainment of the objectives of Section 320.2 , and to ensure adherence to performance standards, CRMC specifies design, construction and maintenance standards for stormwater systems:

Section 320.2 D.

1. Discharging runoff directly into the (Narrow River) and its tributaries, or enlarging the volume, rate, or further degrading the quality of existing discharges is prohibited. Instead, runoff shall be routed through vegetated swales and other structural and nonstructural systems designed to increase time of concentration, decrease velocity, increase infiltration, allow suspended solids to settle, and remove pollutants; such systems will utilize overland flow and re-infiltration as priority techniques for the treatment of runoff;
2. Retention and detention ponds, and methods of overland flow may be used to retain, detain, and treat the increased and accelerated runoff which the development generates;
3. Water shall be released from detention ponds at a rate and in a manner approximating the natural flow which would have occurred before development, incorporating the following standards;
 - a) Peakflow discharges from 1 year, 2 year, and 100 year storms will not be increased by the development or activity;
 - b) Ponds shall not be placed where their use poses concerns of groundwater contamination through the recharging of pollutants from surface runoff;
 - c) Detention ponds shall have a minimum containment time of 36 hours, a minimum sump depth of 3 feet, and whenever possible utilize permeable sides and/or bottoms so as to minimize outflow;
 - d) Outflow from structural devices shall have flow proceed to natural vegetated areas or vegetated swales when discharging in proximity to watercourses, wetlands, and the estuary; such areas utilized for sheet flow should have hydrologic and vegetative characteristics adequate to insure that stormwater reaching the watercourse, wetland, or estuary does so in a manner approximating predevelopment or existing conditions.
4. Natural watercourses shall not be dredged, cleared of vegetation, deepened, widened, straightened, stabilized, or otherwise altered. Water shall be retained or detained before it enters any natural watercourse in order to preserve the natural hydrodynamics of the watercourse and to prevent siltation or other pollution;
5. Intermittent watercourses such as swales, should be vegetated;
6. The first 1 inch of runoff from impervious surfaces, such as rooftops and paved surfaces shall be treated and reinfiltreated on the site of the development;
7. Runoff from parking lots and roads shall be treated to remove oil and sediment;

CRMC requires that the basic design criteria, methodologies, and construction specifications be those of the U.S. Soil Conservation Service, as described in specifically cited publications. (See Section 320.2 E.)

2.4 SPECIAL PROBLEMS IN MANAGEMENT OF RUNOFF

LAWN CARE-RELATED CONTAMINANTS

Findings and Concerns

Pesticide and fertilizer application on home lawns has increased steadily since the beginning of the 1970's, and chemicals are frequently applied adjacent to impervious zones having high potential for surface runoff. The Long Island NURP study monitoring results indicate that medium density residential development has the highest loading factor of any land use studied (Long Island Regional Planning Board, 1982). Other researchers have identified turfgrass, in particular, as a source of substantial levels of contaminant leachate.

A 1980 survey conducted by Cornell University showed that 39 percent of the residential land on Long Island was in turfgrass (130,000 acres) and that an additional 26,000 acres of turf was associated with commercial development. The study found a direct correlation between fertilizer use and affluence, with wealthier communities heavily utilizing lawn care services (Cornell Water Resources Inst., 1985).

The Long Island study assembled a range of statistical data on application. In the most affluent communities, 98 percent of residents used fertilizers on their lawns and gardens, 72 percent used lawn care services, and the average fertilizer application rate was 3.3 pounds per 1000 square feet of turf. In the least affluent neighborhoods, 45 percent of residents used fertilizer and none subscribed to lawn care services. In those areas, the average fertilizer application rate was 1.1 pounds per 1000 square feet. Overall, the average for Long Island turfed areas was 2.3 pounds per 1000 square feet, or between 6500 and 8500 tons of fertilizer applied annually. On mature lawns, any amount over 1 pound per 1000 square feet is excessive, and is likely to reach receiving waters via runoff or leaching into groundwater (Cornell Water Resources Inst., 1985).

Attribution of residential loadings depends upon the extent of sewerage and the condition of ISDS. In sewerage areas, where the primary source of nitrates is turf and garden care practice, the 1980 Long Island study showed that nitrate levels were correlated with housing density, such that levels ranged between 3.0 to 4.3 ppm at one house per acre, and up to 11 to 15.5 ppm. at densities of five to ten houses per acre. The authors concluded that, though affluent neighborhoods fertilize more readily, smaller house lots have higher proportions of land in turf (Cornell Water Resources Inst., 1985).

The Planning Board of the Town of Falmouth cited other studies of the use of fertilizer on lawns which showed a range of averages from 1.52 lbs. N per 1000 square ft. (standard deviation 1.4) to 3.75 lbs N per 1000 square ft. Socioeconomic and environmental factors identified as playing a large part in the size and fertilization of lawns included average income of residents; age of the development; zoning status; maturity of lawns; size and age of trees in the area; topography of land area (Memorandum to the Falmouth, Massachusetts Planning Board from K. Buckland, Town Planner, Nov. 25, 1986).

Golf courses, cemeteries, and other heavily landscaped areas have also been sources of concern with regard to contaminant loading. On Long Island, in the same study, researchers found that more fertilizer (4.3 pounds/1000 square feet) is used on golf course greens than on fairways (3.1 pounds/1000 square feet). However, fairways constitute 74 percent of the course area, and clippings are left to serve as mulch, so nitrate levels are

actually higher beneath fairways (15 ppm, compared to 9.3 ppm beneath greens) (Cornell Water Resources Inst., 1985). Technical personnel interviewed during the course of the present study considered underground irrigation mechanisms to be a significant potential concern on golf courses, as these devices could accelerate transport of nitrate-laden soil percolate.

In Narragansett Bay, leaching of nitrate-N is of considerable concern along the northern and western shores where sandy, unconfined aquifers drain into the Bay. Nitrogen limited coastal estuaries, bays, and coves may be degraded by concentrations of nitrate-N far below the U.S. drinking water standard of 10 mg per liter.

In Rhode Island as a whole, DEM Division of Agriculture personnel interviewed have expressed concern that homeowners routinely apply excessive amounts of fertilizer and pesticide, although federal labelling requirements stipulate that containers clearly describe proper application practice. On the basis of consumer questions and disposal of containers at DEM hazardous waste collection days, DEM is concerned that supplies of banned chemicals such as chlordane and DDT are still being applied by homeowners.

Research conducted by Gold and Sullivan at the University of Rhode Island was designed to evaluate the waterborne losses of nitrogen and the herbicides 2,4-D and Dicamba from home lawns. The two pesticides were selected because they are among the most common agrichemicals used on home lawns, have been found to leach in sandy soils, have been detected in Great Lakes basin surface waters, and could affect marine vegetation. Simulating typical application rates and formulations use by commercial lawn care operations, and using two irrigation schedules that simulated adequate and overwatered treatments, the investigators measured input to receiving waters. Results showed that substantial increases in nitrogen loadings to groundwater resulted from overwatering of fertilized lawns. Overwatering caused a 16 fold increase in the annual loss of inorganic-N in soil water percolate, demonstrating the key importance of water management in offsite losses of N. Pesticides did not appreciably migrate to groundwater in the study (Gold and Sullivan, 1987).

Recommendations to the General Assembly

****Amend pesticide control regulations to require a consumer notification provision stipulating that commercial lawn care operations must place clear warning signs on all properties where pesticides are applied. Landowners would be required to leave the notification signs in place for three days following each application. (This practice is required by the Massachusetts Pesticide Control Act, MGL Chapter 132b.)**

Recommendations to RIDEM and CRMC

*****Work with towns to identify sensitive areas where further nutrient and/or pesticide loading to waterbodies and groundwater should be controlled.**

Recommendations to Town Councils

*****Consider developing zoning or subdivision regulations which allow the Planning Board to request an Environmental and Economic Impact Statement (EIS) for subdivisions of 3 units or more. The EIS requirement**

would be designed to enable towns (in cooperation with applicable state agencies) to consider the cumulative impacts of development on town resources and service needs. (See Local Governments)

Results of the cumulative impact analysis would be compared with local, state and federal performance standards, and should include, at a minimum, provisions for determination of nutrient loading and consideration of runoff and sedimentation impacts. Falmouth, Massachusetts has applied a subdivision ordinance and analytical methodology which include use of a nutrient loading model that account for inputs from human waste, lawn care, and road runoff. (See Activities in other States)

****To control adverse impacts on groundwater and on Bay water quality, develop an aggressive public education campaign to inform home-owners regarding proper use, handling, and storage of fertilizers and pesticides. Detailed information on rate and timing of application and irrigation should be included. In critical areas, consider establishing community standards limiting the use of fertilizers on home lawns, and severely restricting use of commercial lawn treatments unless operators conform to established standards. Covenant restrictions containing such standards could be placed on subdivision properties, compounds or other properties potentially contributing significant loadings.**

Similarly, consider establishing policy standards for use of alternative ground cover, focusing on indigenous or introduced species with low level water and nutrient requirements.

****Using the results of the Environmental Review recommended in the related chapter on ISDS, results of loadings data from state and federal performance standards, nutrient and contaminant loading data assimilated from EIS results, and other available data on the condition of resources, establish a procedure by which town growth and development policy can be revised to consider cumulative impacts of development on natural resources which support public welfare.**

*****Adjust zoning density to specifically consider cumulative impacts of development-related resource contamination, to reflect siting limitations identified in the environmental review or in other research on the carrying capacity of the resource base, and to be consistent with public health protection objectives.**

ROAD DEICING

Introduction

Until recently, the use of road salt to accelerate melting of ice and snow has steadily accelerated. Between 1972 and 1978, use of road salt by the Rhode Island Dept. of Transportation averaged 50,587 tons annually for snow removal on state and interstate roads (Division of Planning, 1981). Both the use and storage of road salt can have several deleterious effects, including:

- degrading the quality of receiving waters;
- adversely affecting roadside vegetation;
- reducing soil permeability;
- contributing to corrosion of automobile parts;

- damaging highways; and
- corroding and damaging underground utilities such as water mains, electric lines, and telephone cables.

In drainage areas of enclosed coastal embayments, delicate salinity regimes may be altered by the impacts of salt-laden runoff, particularly when periods of warm temperatures induce melting of accumulated salt build-up. Pulses associated with heavy rainfall may also be deleterious.

Salt storage has been responsible for some chloride contamination of wells, but primary contamination has resulted from application to roads. Due to the slow flushing rate of groundwater, it is more susceptible to sodium and chloride contamination than surface waters of the state, which have not yet been substantially affected by salting activities. Salt has impacted groundwaters in the state, however. Storage areas have been inventoried, and management recommendations were made to towns and the Dept of Transportation in the Rhode Island 208 Areawide Water Quality Management Plan.

Use of lower salt to sand ratio mixes in deicing has affected sediment loading, in ways which should be accounted for in sediment management. In an effort to determine the role which deicing sand plays in sediment accumulation in detention basins, DEM conducted a survey of towns in 1986/1987 to determine sand application rates. An average application rate was determined to be 28.7 tons of sand/mile/year based on responses of six towns.

Findings and Concerns

Salt storage application practices recommended by the Rhode Island 208 Plan have been unevenly applied. In part, resistance to the use of reduced salt-to-sand ratios comes from attitudes of public works agencies and snowplow operators, but motorists' expectations are also at issue. Towns in the Scituate Reservoir watershed have moved to reduce salt-to-sand ratios well below that used by the R.I. Dept. of Transportation, but towns in other areas of the Bay watershed have been slower to change. In 1981, the Division of Planning estimated that 3 to 4 percent of stockpiled road salts are lost to the environment through runoff or leaching annually.

Recommendations to Towns and the Dept. of Transportation

****All environmentally sensitive areas associated with present or potential ground or surface water supply use should be managed according to the principles and policies set out by the Division of Planning and the Department of Transportation in the Scituate Reservoir Road Salt Proposal. In all other areas, use of road salt in winter highway maintenance should be minimized to the greatest extent possible.**

****All salt should be stored in permanent closed structures located on impermeable surfaces, to eliminate estimated loss.**

Recommendations to RIDEM

By November 1, 1988, DEM should implement the Draft Road Salt Storage Regulations.

2.5 NEW STATE INITIATIVES TO ADDRESS STORMWATER MANAGEMENT AND SEDIMENT AND EROSION CONTROL

Findings and Concerns

In order to ensure proper coordinated commitment to stormwater and sediment management on the part of all involved agencies, municipalities and property owners in the state, a consistent interagency approach needs to be developed, preferably confirmed via legislative initiative. The state regulatory programs now in place do not have jurisdiction over all development situations in which runoff, erosion, and sedimentation cause adverse water quality impacts. Nor are local municipalities for the most part technically or financially equipped to deal with these issues in an aggressive manner, although certain towns have made auspicious beginnings.

Whether implementation of controls is based primarily on networking and expansion of existing state programs or on development of local regulatory and planning initiatives, specific state standards need to be established to ensure consistency, predictability, and public accountability. At the same time, a grant-in-aid program should be established to encourage development of targeted state-local initiatives in critical areas.

DEVELOPMENT OF A GRANT-IN-AID/LOAN PROGRAM

Introduction

As a component of state non-point source control initiatives undertaken pursuant to the requirements of the Water Quality Act of 1987, Rhode Island should develop a financial assistance program modelled on the Clean Lakes Program as applied in other New England states. With respect to coastal areas of the state, the grant/loan program would be targeted toward application in confined embayments or small estuaries of the Bay where non-point source pollutants contribute significantly to water quality degradation. The program would serve to target implementation funding toward resource areas severely affected by non-point source inputs, and in which strong local interest and initiative could be built upon.

Grants would be made available in very high priority resource areas where control programs were in place and operating according to state-established criteria. Low interest loans would be made available in high priority areas where programs were being put in place, but were not yet fully operating. Funding would be made available for research and implementation, but would be restricted to control programs established on a *watershed management basis*.

To encourage research and management integration, special funding would be made available in two areas where shellfishing closures are primarily attributable to non-point inputs. (ISDS impacts, as well as stormwater runoff and sedimentation impacts, could be included.) In these case study areas, funding would be provided for a one year intensive research and management effort, in which controls would be put in place and results in the impacted shellfishing areas would be

monitored. The two project areas selected would differ in the degree and type of non-point source impact manifested in the shellfish beds. Depending on the degree of improvement demonstrated within a given time span, follow-on implementation funding would be awarded.

Rhode Island has placed little emphasis on Clean Lakes program participation, because the program does not make funding available for application to salt ponds or water supply sources. Nevertheless, the program has been applied in neighboring states and offers a useful model.

Rhode Island's Non-point Source Assessment Report and Non-point Source Management Plans, prepared by the DEM Office of Environmental Coordination as required by Section 319 of the Water Quality Act, classify state waterbodies according to the impacts of various non-point source inputs and the need for controlling those inputs in order to meet applicable water quality standards. These reports, in addition to other scientific data and results of research sponsored by the Narragansett Bay Project, will be used by the state to target non-point source program efforts.

In New England states participating in the Clean Lakes Program, lakes have been classified according to trophic condition. Diagnostic/feasibility studies have been undertaken to determine the causes of eutrophic conditions and alternative techniques for restoration and/or protection of the lakes. Each state prepares a list of threatened and impaired lakes, setting priorities for action. EPA provides states Phase II grants to implement selected restoration and protection plans, which are developed jointly by the state and municipalities.

Initiative for restoration and protection comes from municipalities, local watershed and lake protection associations, and other concerned groups. Communities work with the state in researching the issues, coordinating with other involved agencies and groups, preparing the plan, and implementing controls. The Clean Lakes Program affords EPA and the states great flexibility in designing and implementing projects, but is also conducive to a highly integrated and unified approach to restoration and protection.

The geographical approach to water quality management demanded by the Clean Lakes program has been identified as a key element in its success in addressing non-point source control and groundwater protection. Because projects must be developed on a watershed basis, holistic approaches have been taken involving watershed-wide installation of agricultural BMPs, water quality based permitting, and stormwater permitting.

The Clean Lakes watershed approach also parallels the general basin and watershed-based management and data organization strategies used by other natural resource management agencies that are important in non-point source program development (including the Soil Conservation Service, the U.S. Geological Survey, the U.S. Fish and Wildlife Service, and the Corps of Engineers, and their counterpart state agencies). RIGIS data is also organized on a watershed basis.

A financial assistance program modelled on, for example, Maine's carefully developed Clean Lakes Program, could involve towns in a comprehensive resource protection program which would require assessment of point and non-point source control needs, and development of innovative, integrated solutions. The development of the Salt Ponds and

Narrow River SAM plans have amply demonstrated the potential of locally initiated research and management action in Rhode Island.

State implementation funding obtained through the federal Water Quality Act initiatives could be made available to municipal agencies through interagency agreements, pending availability of implementation funding under Section 319 of the Water Quality Act. Alternatively, legislatively authorized funding could be made available for grants and low interest loans.

State-Local projects within the general grant-in-aid/loan program and the special shellfishery case study program would be selected according to EPA's application review criteria, as well as state criteria to be developed. Criteria would consider technical feasibility, projected overall ecosystem response, projected effect on fisheries and wildlife habitat, public benefits, environmental impacts, State priority ranking, factors influencing the projected operation and maintenance program, and monitoring requirements.

DEVELOPMENT OF A NETWORKED REGULATORY PROGRAM

Introduction

Rhode Island presently faces major policy questions with respect to stormwater management and erosion/sedimentation control. Given the partial regulatory authority that is provided by the CRMP and Freshwater Wetlands Programs, and by erosion and sedimentation control enabling legislation, the state faces the challenge of integrating these tools via application of uniform policies and regulatory requirements.

During the course of the past year and a half, DEM's Stormwater Management and Erosion Control Committee has developed policy and technical guidance on stormwater management, and has prepared extensive technical revisions to the Rhode Island Erosion and Sediment Control Handbook. These carefully researched documents are intended to provide the basis for policy revisions among involved state permitting bodies. In addition, the guidelines and revised Handbook provide specific technical guidance to be applied by state and local agencies in their permit reviews and operations, and by contractors.

The results of the present research effort indicate that state legislation is needed to clarify regulatory objectives and applicability, provide coherent program structure, define state and local responsibilities, and provide a mechanism for funding authorization. The legislation would support, strengthen, and clarify the roles of presently involved agencies, providing them a firm, clear, consistent basis from which to operate. Towns electing to exceed the stringency of the state framework would be provided pass-through funding to implement programs under state over-sight, with the recommended grant-in-aid program providing encouragement for targeted implementation.

Until comprehensive legislation can be put in place, the existing sediment/erosion control enabling statute needs to be significantly strengthened to include stormwater management, require mandatory participation, clarify objectives and procedures, incorporate the new state stormwater and erosion/sedimentation provisions as technical requirements, and provide for state oversight and funding authorization.

Recommendations to the General Assembly

*****1. (a) Amend Chapter 12, Rhode Island General Laws to provide a statutory basis for a coordinated state-local program which would protect the state's waters via integrated management of stormwater runoff and control of erosion and sedimentation, building upon the strengths of existing programs.**

The purpose of the amendment would be to protect, maintain, and enhance the public health, safety, and general welfare by establishing minimum requirements and procedures to control the adverse impacts associated with increased stormwater runoff and sedimentation. Proper management of stormwater runoff and control of sedimentation will: minimize damage to public and private property; reduce the adverse effects of development on land resources, reduce stream channel erosion and erosion of coastal lands and features; and reduce local flooding and storm damage. Proper management will maintain after development, as nearly as possible, the site's pre-development runoff levels, soil retention and hydrologic and geologic characteristics, and, where possible, will reduce existing site runoff and sedimentation levels.

The amendment would be designed to ensure a basic level of consistency among all state and local regulatory programs and to provide municipalities the authority to develop additional controls as necessary to meet local needs. Terms of the amendment would itemize state program requirements which would be applicable in all cases. Whether or not towns elected to develop programs exceeding the stringency of the basic state program, certain inspection and maintenance responsibilities would fall to the towns. Town implementation responsibilities would be supported jointly by permit and inspection fees, by a stormwater utility fee structure, and by state pass-through funding.

Necessary minimum provisions for local ordinances would also be provided as a model, but each local jurisdiction could tailor its stormwater and erosion control program to local needs, if those needs indicated cause for implementation of a program more stringent than that devised and enforced by the state. In that respect, rural jurisdictions facing strong development pressure might incorporate the requirements in developing an entire ordinance supporting implementation of an effective program, while urbanizing or heavily developed jurisdictions might focus on retrofitting of existing structures and controls.

Local ordinances developed or amended to meet the requirements of the legislation should be subject to approval by a review group representing the Division of Planning, the DEM Office of Environmental Coordination, CRMC, and the Conservation Districts.

***** (b) Designate Sensitive Areas and Critical Areas in which special standards will apply, based on resource vulnerability.** This study proposes a two-tiered sensitive area definition, identifying Sensitive Areas on the basis of soil characteristics, slope, hydrologic and geologic characteristics and potential water supply resource availability, and Critical Areas on the basis of (in addition to these factors) current water supply utilization, and location in geographic zones influencing coastal resources.

The two-tiered definition is based upon the precept that escalating development occurring and anticipated in the state demands that all soils presenting significant erosion potential (in the natural state of the soil strata prior to draining, excavation, or other alteration) and all stormwater must be considered as presenting potential risk to watershed

and coastal resource viability, in terms of ecological and hydrologic and geologic alteration, and flood storage capacity. (See related chapter on ISDS.)

***** (c) Provide funding authorization sufficient to:**

- provide pass-through assistance funding to towns having approved by-laws for resource inventory and problem assessment;
- provide pass-through funding to towns having approved programs exceeding the stringency of the proposed state program for a portion of local program operating expense;
- provide for DEM, CRMC, and Division of Planning staff support to ensure state oversight and adequate technical assistance for local program development and implementation;

*****2. Amend the existing erosion/sedimentation control ordinance (Chapter 46, Rhode Island General Laws) to:**

- include stormwater management provisions,
- be consistent with the objectives of the 1987 amendments to the Federal Clean Water Act,
- specifically include the technical guidelines of the Stormwater Management and Erosion Control Committee,
- require uniform application of the revised Rhode Island Sediment and Erosion Control Handbook in all planning and regulatory procedures, and in the operations of town departmental bodies or services, and to
- conform with the other recommendations contained in this plan, as applicable.

The revised erosion and sediment control ordinance should specify the minimum content of local municipal ordinances and programs, specify terms for state oversight, and require that approved programs be put into effect by 1990 at the latest in order to comply with federal Clean Water Act requirements.

*****3. Amend the Rhode Island State Zoning Enabling Act (RIGL 45-24) to provide towns full authority to address the impacts of land use on the public welfare, and to protect water quality.** Towns must have full authority to protect public health, welfare, and the public purse, through zoning, subdivision and health regulations, and other ordinances, by-laws and regulations as needed to exercise control over: stormwater runoff, earth removal, erosion, landfills, on-site sewage disposal facilities, sewerage, marine discharges, water conservation, and other local concerns.

*****4. As a component of the annual transportation capital outlay, include a program to provide grants to local communities to improve drainage facilities adjacent to roads, highways, bridges, and other structures contributing stormwater and sediment loadings to sensitive receiving waters.** Review of local proposals and award of grant funds would be made by a joint committee of the Division of Planning, water supply providers, DOT,

DEM, and CRMC, and would be coordinated with the recommended grant-in-aid program outlined above. (A grant program of this nature is being put in place in Massachusetts.)

Recommendations to the Department of Highway Safety and Motor Vehicles

****Revise state vehicle inspection requirements to address oil leakage from valve cover seals.**

Recommendations to the Department of Revenue

****Amend the tax-exempt provision of Chapter 44-3-3 (22) to apply to the installation of best management practices for management of stormwater and control of sedimentation. Any real or personal property acquired or altered to control non-point source pollution should be given the same tax-exempt status as property acquired to control industrial pollution.**

CONTENT OF RECOMMENDED PROGRAMS

Recommendations to State and Local Regulatory Bodies Having Jurisdiction over Relevant Development Activities

General Recommendations

****Standards put in place at the state and local level should include both detailed design and construction specifications *and* performance specifications.**

*****Require that all state agency construction activities comply with all applicable stormwater and sedimentation control requirements, including established construction and performance standards.**

****Specify flood and erosion control requirements which forbid post-development increase in 2- and 25- year watershed peak flows.**

Guidebook

*****Prepare an illustrated two volume guidebook to be used in planning and zoning, and in designing and maintaining integrated stormwater management and erosion control facilities. The handbook should be designed to provide guidance to town officials regarding pollution parameters and potential flood hazards associated with specific development types, and to provide technical design, construction, and maintenance specifications for officials and developers.**

*****Include a tabulation of potential applicability of specific requirements for different proposed land use developments (including, for example, residential, institutional, commercial, industrial, open space). The tabulation, and accompanying factors, would be intended to provide applicants as much pre-design specificity and predictability as possible regarding the requirements likely to be imposed. Further, clear guidance would be provided to town officials regarding issues relevant to planning and permit conditioning.**

As a basis, categorize the development types by specific factors related to expected runoff and erosion, including: typical area of paved parking, typical area of storage, sidewalks, playgrounds, etc., and typical roof area. (These factors are available in the literature and are used in regulations applied in other states. See, for example, Wisconsin.)

Provide adjustment factors to be used in deriving applicability of various standards. These factors would include, for example, slope, availability of buffer zones of specified dimensions, slope and soil characteristics of the buffer zone, percent and type of vegetative cover on the site and in the buffer zone, etc.

As a companion to the categorization, include lists of typical contaminants contained in runoff and sediment from the land use categories considered. List example concentrations for first-flush one inch runoff for selected storm intervals.

Stormwater Management and Sediment and Erosion Control Plans

General Requirements

*****Require submission of Integrated Stormwater Management and Erosion and Sediment Control Plans on all applicable properties, to be developed as part of the site planning process. The specified plan format should be developed so as to include the following elements:**

- applicability determination
- clear map of pre-construction site conditions and post-development proposed site conditions
- site construction plan
- complete description of pathway by which decisions have been made regarding design of control practices and measures, including:
 - calculations methods applied, and summary of calculations
 - how design criteria, standards and specifications for control measures have been achieved
 - extenuating circumstances at issue, and any resulting requests for variances or special exceptions
- complete description of *preventive* control measures to be applied, and schedule for maintenance of preventive measures
- practice/control measure specifications and installation schedules for the following site-specific control elements:

Erosion Control

- a) site dewatering
- b) waste and material disposal
- c) tracking
- d) drain inlet protection

- e) site erosion control
- f) any other construction site control measures specified by applicable regulations

Management of Stormwater

- a) control of discharge from large roofs
- b) control of drainage from non-industrial medium sized paved parking lots and storage areas, and from large non-industrial paved parking lots and storage areas
- c) control of discharge from large parking areas
- d) control of drainage from industrial sites of less than 100,000 sq. ft. and from industrial sites of more than 100,000 sq. ft.
- e) control of drainage from all other paved areas

A. Specific Erosion Control Requirements

Applicability

*****Prepare clear guidance regarding specific erosion control practices to be required for different types and sizes of construction projects.** In that respect, set threshold criteria based on extent of land disturbance (in terms of acreage of land disturbed); extent of excavation or filling (in terms of volume of material affected) , and other factors relevant to erosion (including slope, soil character, etc.)

*****Specify that *all* subdivisions, *all* projects involving placement or repair of roads, *all* utilities, and *all* projects involving placement or repair of underground pipe of specified dimensions must comply with applicable controls, without exception.**

****Require submission of integrated stormwater management and sediment and erosion control plans for all applicable developments.**

Design and Performance Specifications

****Specify alternative erosion control measures to be applied to developments within clearly defined categories based on size of site, area of disturbance, location of the site in a critical area, and other measures indicating extent of disturbance or potential effect.**

****Specify an order of preference for practices which will be adhered to in review, but provide the designer as much flexibility as possible in meeting applicable standards.**

In defining specific site requirements, establish design criteria which establish:

- a) calculation methods to be used in deriving design specifications
- b) required safety features

****For sites of less than 10 acres in size, require placement of filter fences, straw bales or equivalent control measures at side slopes and at down-slope sides of the site.**

****In critical areas (water supply watersheds, coastal areas, water supply well recharge areas) require that sedimentation basins and infiltration devices (where appropriate) be installed on all sites as necessary to prevent disturbed areas from contributing to sediment erosion.**

****Require that sediment laden waters from the site be treated in an appropriate facility designed to remove particles of 100 microns or greater for one year design storms or for the highest dewatering pumping rate, whichever is most critical.**

Construction and Maintenance

*****Work with towns to ensure that local building officials, environmental officers, or Conservation District Personnel inspect sediment/erosion control installations to ensure compliance with specifications and adequacy of function as outlined below, and in the related sub-section on enforcement. Require that issuance of occupancy permits be contingent on compliance with the permanent sediment and erosion control measures specified in the applicant's permit.**

****Require that no runoff may enter the project construction drainage area until adequate temporary runoff and erosion controls have been installed.**

*****Develop permit conditions which place full responsibility for maintenance of facilities on the contractor.**

****Ensure that project scheduling, and seeding and mulching schedules and practices outlined in the plan are adhered to.**

*****Provide detailed maintenance requirements which ensure that practices/controls operate in conformance with applicable construction and performance standards.**

****Given that the timing and severity of erosion and sedimentation impacts will depend on project duration, seasonality and climatic factors, provide for inspection of facilities at appropriate junctures during the process of construction of *all* primary control facilities, or, at a minimum, at least twice during project construction. Provide for inspection to ensure that the developer has adequately provided for the preventive maintenance of installed structures, particularly following storm events.**

****Provide for revision of permit specifications to require structural modifications if changed hydrologic or other circumstances dictate that the facility must be upgraded in order to meet water quality protection needs.**

B. Specific Stormwater Management Requirements

Applicability

*****Specify that *all*: subdivisions; projects involving placement or repair of roads; utilities; projects involving placement or repair of underground pipe of specified dimensions; feed or holding lots which provide for a specified number of animals; storage or distribution systems for petroleum products or chemicals; storage, distribution or treatment systems for liquid waste; solid waste storage, disposal, or incineration sites; sludge or sludge**

effluent application sites; and radioactive waste-related sites must comply with applicable controls, *without exception*.

****Establish design, construction, and performance standards to accomplish the dual goals of control of runoff and maintenance of groundwater infiltration levels, where recharge of stormwater would not contribute to groundwater contamination.**

*****Prepare clear guidance regarding specific runoff control and infiltration enhancement practices to be required for different types and sizes of construction projects.** In that respect, set threshold criteria based on aggregate area of land involved; extent of impervious surface coverage; extent of lawn coverage; and other factors relevant to runoff (including slope, existing drainage characteristics, etc.) Specify means by which other development projects are to be included in the stormwater management program if they: contribute to stormwater runoff resulting in exceedance of the safe capacity of existing drainage facilities or flood storage capacity; cause channel erosion, scouring, or particulate transport; or endanger downstream property.

****Require submission of integrated stormwater management and sediment and erosion control plans for all applicable developments.**

Design and Performance Specifications

****Specify an order of preference for practices which will be adhered to in review, but provide the designer as much flexibility as possible in meeting applicable standards.**

****Develop runoff calculations (based upon SCS curve numbers for various hydrologic soil groups) to use in calculating runoff volume so as to provide control of post development volumes resulting from a one year design storm ranging in duration from one half hour to 24 hours duration.**

****Use Stormwater Management and Erosion Control Committee guidance (hereafter Committee Stormwater Guidance) regarding stormwater management to make determinations as to the appropriate use of infiltration basins.** (Careful evaluation of potential groundwater impacts is required in decision-making regarding this issue.) Establish standards and specifications for all practices which ensure compatibility with safety concerns and other resource protection objectives. For example, with respect to safety and groundwater protection considerations of concern in siting of infiltration basins, set standards and specifications to ensure that:

- a) infiltration systems are not used to receive large volumes of contaminated runoff
- b) infiltration systems do not undermine the structural integrity of neighboring structures
- c) infiltration systems receiving small to moderate amounts of contaminated runoff have incorporated treatment devices or are located a sufficient distance from public or private water supply wells to provide adequate natural treatment.

****Require that in watersheds not currently used for water supply, sedimentation basins and infiltration devices be installed (as indicated to be appropriate by Committee Stormwater**

Guidance) in all subdivisions having impervious area (including roads, driveways, and sidewalks) in excess of 20 percent of the aggregate site area.

****In critical areas (water supply watersheds, coastal areas, water supply well recharge areas) require that sedimentation basins and infiltration devices be installed (as indicated to be appropriate by Committee Stormwater Guidance) in all subdivisions having impervious area (including roads, driveways, and sidewalks) in excess of 10 percent of the aggregate site area.**

****Develop detailed standards and specifications for off-site detention and retention structures, providing for limitation on contributing drainage area, management of deicing sand, control of runoff, settling to provide attainment of water quality standards, storm flow management, etc.**

*****Require that discharges to receiving waters meet applicable water quality criteria, via specified treatment methods if applicable.**

****Require that stormwater management facilities receiving runoff from areas which are a potential source of oil and grease contamination in concentrations exceeding applicable water quality standards include as components baffles, skimmers, grease and oil traps, and other facilities sufficient to ensure proper treatment. (See also maintenance provisions below.)**

Construction and Maintenance

****Work with towns to ensure that local building officials and/or Environmental Officers verify recordation of notice of permit and notice of completion of permit in the land evidence records of the municipality in question as per Chapter 13 of Title 34 of RIGL.**

*****Require that issuance of occupancy permits be contingent on compliance with the permanent stormwater runoff management measures specified in the applicant's permit.**

****Require that no runoff may enter the project construction drainage area until adequate temporary runoff and erosion controls have been installed.**

****Require that no runoff be allowed to enter infiltration systems until the full contributing drainage area has received final stabilization.**

****Specify procedures for maintenance of baffles, skimmers, grease and oil traps, and other facilities receiving runoff from areas which are a potential source of oil and grease contamination.**

*****Develop permit conditions which place full responsibility for maintenance of facilities on the contractor until the buyer assumes ownership, and then transfer responsibility to the owner or to the town, depending upon the type of facility at issue and the maintenance required. (Experience in other states has shown that for certain types of facilities, regular town maintenance under a utility or permit fee schedule is much more effective than owner maintenance.)**

*****Provide detailed maintenance requirements which ensure that practices/controls operate in conformance with applicable construction and performance standards.**

****Provide for inspection of facilities during the process of construction of all primary control facilities, or, at a minimum, at least twice during project construction. Provide for inspection at the completion of construction, during the first year of operation, and then at least once every two years to ensure that the developer has adequately provided for the preventive maintenance of installed structures.**

****Provide for revision of permit specifications to require structural modifications if changed hydrologic or other circumstances dictate that the facility must be upgraded in order to meet water quality protection needs.**

Review of Integrated Control Plans

*****Develop a specified permit review schedule to ensure adequate, timely, consistent review of plans:**

1. Notification to town planning and zoning boards, wastewater management districts, other applicable municipal bodies
2. Pre-design conference with applicable regulatory agencies, for projects meeting specified thresholds indicative of potential impact
3. Review by CRMC, Freshwater Wetlands Section, Groundwater Section
4. Coordinated Review, if applicable
5. Definition of permit conditions required to meet applicable state requirements
6. Review by town councils
7. Definition of permit conditions required to meet additional municipal requirements

Issuance of Permits

****Define duration of permit and permit conditions, including seasonally applicable control conditions.**

****Define conditions under which permits may be extended, specifying that additional control measures may be required as a condition of the extension if necessary to meet stormwater management and erosion control objectives.**

****Define maintenance and inspection schedules to be attached to permits issued by applicable agencies. (see below)**

*****Define conditions under which applicants must deposit a surety bond or irrevocable letter of credit to guarantee a good faith execution of the control plan and any permit conditions.**

****Define performance standards which practices/controls must meet in order to qualify for release of the surety bond or irrevocable letter of credit.**

****Define performance standards which practices/controls must meet in order to qualify for reissuance or expansion of the permit in question, or of related permits.**

****Define procedures which applicants must follow in recording notice of permit and notice of completion of permit in the land evidence records of the municipality in question as per Chapter 13 of Title 34 of RIGL.**

****Require that applicants must obtain written permission from applicable regulatory bodies prior to modifying the control plan.**

Inspection

****Establish notification requirements stipulating that as a condition of permit issuance, applicants must notify the applicable regulatory authorities a specified number of days before commencement of any land disturbing activity.**

****Establish notification requirements stipulating that as a condition of permit issuance, applicants must notify the applicable regulatory authorities a specified number of days after completion of any control measures.**

*****Establish procedures providing for timely inspection of installations to ensure adherence to specifications, adequate performance, maintenance sufficient to achieve consistent performance, and repair of any damage to adjoining public or private property. Provide for inspection of facilities during the process of construction of *all* primary control facilities, or, at a minimum, at least twice during project construction. Provide for inspection at the completion of construction, during the first year of operation, and then at least once every two years to ensure that the developer has adequately provided for the preventive maintenance of installed structures.**

****Establish special post-storm inspection procedures to ensure proper attention to performance, and timely completion of necessary repairs.**

*****To address situations where land disturbing or land developing activities are being undertaken without a permit, define procedures for enforcement referral of landowners.**

Enforcement

*****Define procedures by which an administering authority may post a stop-work order:**

- a) if any land disturbing or land developing activity regulated under the stormwater management and erosion control program is being carried out without a permit
- b) if the control plan is not being implemented in a good faith manner
- c) if the conditions of the permit are not being met.

****Establish time limits within which, after notice, a permittee must comply with permit conditions in order to avoid revocation of the permit.**

****Define procedures under which cease and desist and stop-work orders may be issued following notice of violation.**

****Establish procedures within which the administering authority or its agent may perform work necessary to comply with the stormwater management and erosion control program and back-charge the permittee or landowner.**

****Define procedures in which, in the event a permittee or landowner fails to pay the amount due, the amount shall be entered on the tax rolls and collected as a special tax against the property.**

*****Establish administrative penalty procedures and fines to apply to all individual violations of performance and construction standards, as reflected in permit conditions.**

2.6 MARINAS AND RECREATIONAL BOATING

Introduction

Water quality impacts of marina-related activities include marina construction, maintenance dredging to maintain necessary water depth, day-to-day marina operation, and boat use. Mooring fields, which are also included in this brief discussion of marina-related non-point source problems, cause water quality degradation associated with boat use. A review of the literature concerning environmental impacts and marinas and boats prepared by Chmura and Ross (1978) outlines key issues. Quantitative scientific measurements of the severity of impact, however, have been fairly limited, and have primarily dealt with effects of specific contaminants such as anti-fouling agents.

The degree to which marina construction activities degrade water quality and alter estuarine habitat depends upon the location and capacity of the facility, shore protection measures installed, amount and location of dredging, building materials used, on-shore site character, and other factors. Alteration of estuarine salt marsh and in-shore habitat, disturbance of unstable shoreline features, and use of anti-fouling treatments on pilings are major concerns.

Maintenance dredging causes increased turbidity, resuspension of organic materials and any associated contaminants, and disturbance or removal of benthic bottom communities. "Agitation dredging," or the disturbance of in-place sediments by propellers or hulls may also cause similar impacts in severe cases. Disposal of dredge spoil, particularly if the material is contaminated with organic matter, hydrocarbons and heavy metals is a major issue

Boat maintenance activities associated with marina operations contribute a range of non-point inputs. Scraping, painting, washing, and dockside refueling introduce hydrocarbons, detergents, and heavy metals (copper, mercury, cadmium, and lead) associated with anti-fouling agents. Stormwater runoff from paved marina site surfaces may contain boat scrapings, spilled paint and oil, sediment, pesticides, nutrients, and debris and litter associated with work and storage areas.

With regard to boat operation, hydrocarbons derived from boat motor exhaust increase contaminant concentrations in the water column and may form a visible sheen on the water surface. Certain constituents eventually reach the underlying sediment. Similarly, anti-fouling paint residuals can cause increased concentrations of heavy metals and other contaminants in the water column, bottom sediments, and tissues of aquatic biota. Theoretical calculations completed during the preparation of the Areawide Water Quality Management Plan (based on flushing rates and boat densities) indicated that Warwick Cove, Apponaug, and Bullocks Cove could be most vulnerable to increased heavy metals concentration.

Because raw sewage discharge from boats contributes to bacterial contamination of shellfish, which may be consumed raw, shellfish beds in marina areas are categorically closed to the taking of shellfish. Sewage discharge also contributes loadings of organic constituents and nutrients to receiving waters. Problems associated with sewage discharge are complex and are not limited to concerns regarding open water discharge. Where wastes are transferred from boats at pump-out facilities, they must go to municipal sewage treatment plants. Not only is plant capacity a major concern in itself for many coastal

Rhode Island communities, but deodorizing agents used in the holding tanks and remaining in the sewage have been shown to pose concerns for operation of the treatment plants.

Findings and Concerns

Section 312 of the federal Clean Water Act requires that all commercial and recreational boats with an installed toilet must have on board an approved "Marine Sanitation Device" or MSD. Three types of MSD are defined according to EPA regulations: Type I and Type II are treatment devices and Type III are no-discharge holding tanks. Boats less than 65 feet in length are required to install either holding tanks (Type III devices) or a Type I treatment device, while boats equal to or exceeding a length of 65 feet must install either a Type II or Type III device.

Although the Coast Guard is responsible for enforcing the EPA regulations, the fairly limited spot-check enforcement effort is restricted to ensuring that the devices are installed. While *installation* may be verified, there is no real way to enforce *use*. Further, neither the Clean Water Act nor federal regulations require the installation of pumpout facilities at marinas, so discharge of raw sewage has become a routine occurrence in many coastal areas. The MSD regulations do allow states to designate "no-discharge areas" to provide water quality protection in sensitive areas.

On the federal level, marina construction is regulated by the Corps of Engineers and EPA through the Section 404 Dredge and Fill permit process, and by the Corps of Engineers through its authority to implement the Rivers and Harbors Act. A 404 permit may be denied based on potential impacts to shellfish resources. With regard to state programs, a CRMC assent is required for marina construction, and a Freshwater Wetland permit may be required where wetlands and floodplains are impacted. DEM's Division of Water Resources issues water quality certifications (based on shellfish area protection) as applicable, which are attached to CRMC and Wetlands permits. Disturbance of toxics-contaminated sediment is addressed under advisement from the Division of Air and Hazardous Materials.

Proposals to dispose of dredged spoil material are reviewed by the Divisions of Air and Hazardous Materials and Fish and Wildlife, in addition to the Division of Water Resources. The Division of Groundwater and Freshwater Wetlands also becomes involved as appropriate.

At the present time, state policy is in transition with regard to marina and mooring field siting and operation. In several respects, issues surrounding marina siting lie at the heart of the conflict between DEM and CRMC water quality and area use designations. DEM designated use classifications, established in 1975, set a non-degradation standard which essentially prohibits uses which alter the capacity of a water area to support specific uses. SA and SB use classifications provide for shellfish harvesting (depuration required in SB areas), bathing and contact recreation, and fish and wildlife habitat. Because a non-degradation standard applies, SA waters can theoretically be considered "no-discharge areas," to the extent that off-shore discharge can be regulated.

Classifications were established based upon water quality *objectives* and *aspirations* as well as [then] current uses, and basically provide for no future discharge. A water body may thus be classified as SA in terms of "designated use" although its "attainable use" classification (as defined in 1981 Amendments to the Clean Water Act) may differ. Where

marinas have been developed in Class SA waters, the classification has generally been changed to SB in the immediate vicinity of the proposed marina, following a required public hearing process. If marinas are permitted in SA waters, pump-out facilities must be provided. DEM's SC classification provides for boating, other secondary contact recreation, fish and wildlife habitat, industrial cooling, and aesthetic value.

Section 300.4 of the Coastal Resources Management Program sets out CRMC policy on marinas. With regard to general policy, CRMC encourages developers to use space efficiently, but favors concentration of slip space in large facilities as opposed to proliferation of small marinas. Municipalities developing harbor management plans are required to obtain council assents to ensure consistency with CRMC policy and state law.

CRMC policy is to prohibit construction of new marinas in Type 1 and 2 waters, although 25 percent expansion beyond 1981 capacity is authorized. Marinas are allowed in all but one of the remaining CRMC water classifications (Type 3 High-Intensity Boating areas; Type 4 Multipurpose Waters; and Type 5 Commercial and Recreational Harbors. Type 6 Industrial Waterfronts and Commercial Navigation Channel areas are reserved for commercial and industrial use.

Because CRMC's water use and shoreline categories draw heavily from adjacent shoreland zoning districts established by municipalities, use designations may conflict with DEM designated use classifications. CRMC Types 3, 4, and 5 are not infrequently designated as SA and SB waters by DEM. Faced by the inconsistency, developers and municipalities have repeatedly challenged the original DEM designation process, claiming that designations were arbitrarily drawn.

Basically, the conflict turns on differences between program mandate and on jurisdictional inconsistency. DEM places program emphasis on impacts of discharges to receiving waters, while CRMC's broad resource management mandate encompasses appropriateness of use. CRMC tends to interpret its jurisdiction narrowly, placing heavy emphasis on the need for support from local zoning.

Neither DEM nor CRMC have sufficient resources to monitor initial or long-term compliance with permit conditions. Once a water quality certification has been issued, DEM has means of monitoring whether illegal discharges are subsequently introduced to receiving waters, or whether the number of boat slips or moorings developed conforms to the vessel capacity permitted.

Mooring fields present special concerns. Although CRMC policy currently requires that mooring plans be reviewed, standards for permit review have never been articulated. DEM and CRMC are presently working to adjust regulatory language to specify that mooring fields will be considered as identical to marinas from the standpoint of regulatory review.

General Recommendations to CRMC and DEM

****Revise permitting procedures and guidelines relating to marinas and mooring fields to ensure consistency of interpretation between the two agencies. Guidelines developed should include specific standards to govern the siting and design of marinas so as to consider water quality concerns as a basis for siting, operation, and maintenance.**

*****Strictly prohibit marina siting in poorly flushed shellfishing areas.**

*****By the winter of 1988-1989, initiate a comprehensive inter-agency study program to develop policies and plans to control sewage discharges from boats. The study group tasks should include:**

- a) designation of critically sensitive poorly flushed coves and embayments where illegal discharge of untreated sewage from boats is significantly contributing to shellfish closures, habitat alterations, or reduced recreational use;
- b) review of the literature on the use of pumpout facilities by boaters; assessment of behavioral issues, locational factors of key concern, and institutional constraints; application of findings to Narragansett Bay
- c) preparation of an inventory of currently available pumpout facilities around Narragansett Bay, their condition and capacity, and their present and anticipated levels and patterns of use
- d) review of issues surrounding potential disposal of waste from pumpout facilities, including capacity of treatment facilities and effects on those facilities of additives used in boat waste holding tanks
- e) recommendation of sensitive embayments, constricted areas, or other poorly flushed areas to be designated as "no discharge areas"
- h) assessment of the need to restrict anchorage in sensitive areas
- f) development of a monitoring strategy to be used in quantifying the impact of boat waste on critical areas, and in testing effectiveness of a pilot "no-discharge" program
- g) review of boater education programs applied in other states to raise the level of boaters' awareness regarding sewage disposal, solid waste disposal, use of petroleum products, and use of chemical products such as anti-fouling paints and cleaning solvents

Using the findings of the study:

****In cooperation with EPA the Coast Guard, and public boating service organizations such as the Coast Guard Auxiliary, initiate a major education program aimed at familiarizing boaters, harbor masters and marina operators with the effects of non-point sources associated with marinas and boat use. Encourage boaters to use MSDs and pump-out stations, and provide clear information on location of facilities and procedures for use.**

****Initiate an education program to encourage good housekeeping practices at marina sites. Oil spills can be minimized by equipping fuel pumps with nozzles preventing overflow. Careful maintenance of pumps, hoses, and other fueling equipment can reduce spills, and strict enforcement of anti-littering regulations can discourage littering. Encourage marina operators to use protective vegetative buffer strips, landscaping, and porous pavement or gravel to reduce runoff.**

*For boats registered in Rhode Island, consider initiating an inspection procedure to monitor engine condition and function, and fuel leakage from components.

***Determine locations of poorly flushed embayments in which recreational and commercial shellfishing, other recreational use, cumulative effects of contamination, habitat degradation and/or other factors indicate the advisability of establishing no-discharge areas. Establish procedures for siting of pump-out facilities in these areas, for buoy marking and signing, and for surveillance of boats.

**Develop a policy providing for required installation of pump-out facilities as a permit condition for construction or expansion of marinas of a specified capacity.

*Consider designating zones within which marinas pool a portion of mooring fees to provide for maintenance of a cooperative pump-out facility. To ensure use of pump-out facilities, marinas could require that receipts from the pump-out be presented at the time of collection of mooring fees.

PART 3: APPROACHING NON-POINT SOURCE POLLUTION VIA LAND USE MANAGEMENT

3.1 MANAGEMENT OF COASTAL LAND AND WATER USES: THE ROLE OF CRMC

Introduction

In 1971, prior to federal legislative action in the coastal management area, the Rhode Island General Assembly formed an autonomous state regulatory agency to address resource protection in the coastal zone. The following year, the U.S. Congress enacted the Coastal Zone Management Act, which set up a grant program to encourage participation in a nationwide effort to provide consistent coastal area protection and management. Under a cycle of "planning" and "implementation" grants made available through NOAA's Office of Coastal Zone Management (now Office of Ocean and Coastal Resources Management), Rhode Island has proceeded with program implementation.

The following sections discuss factors which constrain or contribute to Rhode Island's success in meeting the broad ecosystem management mandate set out in its landmark 1971 coastal protection legislation. These sections concentrate on issues affecting CRMC's exercise of its specific responsibilities, particularly as they affect land use and water area use decision-making. This analysis, and accompanying recommendations, are intended to be reviewed in concert with CRMC program findings and source management recommendations presented in other sections organized by source category.

The State of Rhode Island Coastal Resources Management Program As Amended June 28, 1983, known informally as the Red Book, sets out a "pro-active" and "layered" approach to coastal zone management based on evaluation of both project character and location. The method is intended to give the Council staff a means of assessing the impacts of similar or identical projects at different sites, to judge the appropriateness of various uses in specific coastal settings. Theoretically, land uses can be segregated according to appropriateness in such a way that development is encouraged in areas of lesser impact, while conservation use is fostered in sensitive areas.

CRMC's coastal management mandate is set out in its enabling legislation and includes the following procedural requirements:

1. Identify all of the state's coastal resources: water, submerged lands, air space, finfish, shellfish, minerals, physiographic features, etc.
2. Evaluate these resources in terms of their quantity, quality, capability for use, and other key characteristics.
3. Describe the current and potential uses of each resource.
4. Determine the current and potential problems of each resource.
5. Formulate plans and programs for the management of each resource, identify permitted uses, locations, protection measures, etc.

6. Carry out these resource management programs through implementing authority and coordination of state, federal, local, and private activities.
7. Formulate standards where these do not exist, and reevaluate existing standards.

An initial series of resource management activities shall be initiated through this basic process, then each phase shall continuously be recycled and used to modify the Council's resource management programs and keep them current (GLRI 48-23-1).

In order to expand its effectiveness in addressing cumulative effects, and to achieve improved consistency between state and local government land use decision-making, CRMC instituted special area planning in several critical coastal areas in the early 1980's. Special area plans build on research and management initiatives undertaken in local communities, create a regional identity and constituency within the planning area, and contain action-oriented elements designed to involve local governments, interest groups, and property owners in long-term preservation efforts.

Special area management techniques recognize the need for consideration of all evolved interactions within a specific ecosystem, and the potential ramifications of alteration of one system component in inducing far-reaching effects. The Narrow River Special Area Management Plan, and its development process, revealed many of the opportunities which special area planning presents, as well as its shortcomings.

The SAM planning process attempts to address some of the difficulties presented by sequential permitting by providing for a cooperative permit review procedure for major activities. This Coordinated Review procedure involves joint consultation with relevant agencies early in the planning process.

The objectives of the Coordinated Review process have been to: a) reduce time and expense incurred by the applicant during the permitting process; b) evaluate major development proposals on the basis of shared expertise from each permitting agency; c) identify and evaluate major impacts on the ecosystem at the beginning of the permitting process; and d) reduce possible conflicts with regulatory program requirements by making the applicant aware of what is to be expected prior to entering the permitting process.

The review procedure neither alters existing authorities nor changes the legal basis or sequence by which permits are issued. Agencies remain constrained by their given legislative authority to act upon limited aspects of a proposal, and applicants are still required to meet the stipulations and criteria of each permitting agency. Benefits of the coordinated review permitting procedure include ease and directness of negotiation among developers and affected agencies, improved interagency "education" and broadened opportunity for public outreach.

Towns within SAM plan jurisdictions designate an appropriate official to serve as the Permit Coordinator for the Coordinative Review process. Parties proposing an activity listed as applicable notify the permit coordinator before filing a formal application for any municipal or state permit. Major activities requiring notification of the permit coordinator include:

1. New subdivisions of 6 units or more.

2. Facilities requiring or creating more than 10,000 square feet of total impervious surface area.
3. Construction or extension of municipal, private, or industrial sewage facilities or systems, conduits, or interceptors.
4. All roadway construction and upgrading projects, or activities requiring a DOT Permit of Physical Alteration.
5. Water distribution systems and supply line extensions.
6. Construction or extension of public or privately owned sanitary landfills.
7. Mineral extraction (to be defined by area).
8. Processing, transfer, or storage of hazardous materials as defined by DEM.
9. Electrical generating facilities of more than 10 megawatts capacity.
10. All residential and commercial in-ground petroleum storage tanks; all petroleum processing and transfer facilities of more than 2400 barrels capacity.
11. Proposed stormwater and/or drainage projects.

Agencies of local, state and federal government which must be notified by the permit coordinator when applicable proposals are submitted include:

- 1). The DEM Office of Environmental Coordination, which in turn notifies appropriate departments within DEM.
2. The planning board, zoning board of review, conservation commission, town manager, town planner, and building inspector of the municipality within which the alteration is proposed.
3. The Department of Administration, Division of Planning.
4. The Historic Preservation Commission.
5. Soil Conservation Service.
6. The Department of Transportation.
7. The Coastal Resources Management Council.

GENERAL FINDINGS

Non-point source pollution concerns permeate the consideration of problems that any coastal program must address: comprehensive planning, resource allocation, use conflicts, and turf battles between units of government. **CRMC's broad mandate gives it a unique perspective from which to approach both the planning and regulatory elements of non-point source control, and to work with local governments in creating programs which might most effectively address certain non-point source management needs.**

However, despite the language of Section 46-23-6 D of the enabling legislation, which gives CRMC clear permitting, licensing, and enforcement responsibilities in addition to its planning and management role, CRMC does not conceive of itself as a regulatory agency. Council staff, in interviews, emphasize the distinction between the regulatory mandate of DEM and that of CRMC, which the staff views as centered on management and arbitration. In fact, perhaps because of its heavy permit review load, CRMC's staff is able to place less emphasis on the pro-active planning and management role set out for it by Section 46-23-6 (A) than on supporting the Council's role as a "quasi-judicial review board." CRMC has specifically cited staff shortages as impeding its efforts in working with towns to develop harbor management plans that consider the full range of coastal zone management objectives.

Similarly, special area management plans rely heavily on exercise of local zoning and planning initiative in implementation, and require that much staff time be devoted to coordination and outreach. Lacking staff dedicated to SAM plan follow-through, CRMC has given volunteer citizens action committees responsibilities which are perhaps unrealistic.

SPECIFIC PROGRAM FINDINGS AND CONCERNS

JURISDICTIONAL ISSUES

Findings and Concerns

CRMC's broad ecosystem protection mandate allows it to set ecosystem based discharge criteria within a broad geographical area. A liberal interpretation of Chapter 23 of the RIGL as amended gives CRMC jurisdiction over development in *any area which would affect freshwater flows to estuarine areas*. With regard to dredge spoil disposal and other marine uses, CRMC has primary jurisdiction out to three miles.

At the time of its 1983 program revision, CRMC conclusively established authority over the 200-foot contiguous area landward of coastal beaches, dunes, cliffs, bluffs, embankments, rocky shores and manmade shorelines (collectively termed "shoreline features"), which define the inland boundary of the coastal zone. CRMC also reaffirmed its authority to regulate the six specific activities or land uses mentioned in the Council's enabling legislation "*regardless of their actual location*" - power generating and desalination plants, chemical or petroleum processing, transfer or storage, minerals extraction, shoreline protection facilities, coastal wetlands, and sewage treatment and disposal and solid waste disposal facilities.

In SAM plan areas CRMC has jurisdiction over sub-divisions of 6 units or greater, or areas with parking exceeding one acre, and over a range of development activities as outlined above. SAM plans further require development of regulatory linkages among wastewater, stormwater, and sediment management, and among other land uses and resource protection mechanisms.

By law, project permit applicants and Council Staff are to be guided by elements of the Rhode Island CRMP, applicable SAM plans, and the State Guide Plan Overview, all of which are directly incorporated into the coastal program. In response to a dispute regarding CRMC's authority to regulate activities outside the coastal zone through the State Guide Plan, CRMC issued a "clarification" in 1983 to resolve the inland boundary question. The "clarification" restricted CRMC's ability to regulate activities through the State Guide Plan to the 21 coastal communities.

Much of this land is well beyond the 200 foot area contiguous to coastal features, but may greatly influence the character and integrity of coastal buffer zones. Land use guidance provided by the State Guide Plan provides valuable support to CRMC in meeting its ecosystem management mandate. The State Guide Plan possesses the same formal authority as the Red Book.

Although CRMC possesses broad statutory authority in coastal areas, the Council in practice interprets its authority over inland areas influencing estuarine resources as limited, particularly where urban built-up areas are concerned. Land use within the terrestrial portion of the estuarine ecosystem is governed principally by municipalities, which retained control over land use decisions at the time of the passage of the 1971 Rhode Island Coastal Management Act. The legislation represented a compromise in which CRMC was given exceptional and virtually unequalled authority to carry out coastal environmental protection measures, with the clear understanding that local representatives would dominate the Council, and that local governments would continue to exercise primary land use control.

CRMC is a legislatively created and authorized body, with Council members appointed on a rotating basis by the Governor, the Lieutenant Governor, and the Speaker of the House. Membership on the Council includes local officials, state senators and representatives, members of the general public from coastal communities, and state officials serving *ex officio*. Voting Council members are heavily influenced by local concerns.

Key municipal controls include zoning and subdivision regulations, and the application of municipal tax policy to undeveloped and developing land. There is presently no mechanism to require towns to incorporate coastal area management principles into their zoning policy, or to notify CRMC when a zoning or regulatory change is anticipated which would involve coastal resources. Furthermore, towns have viewed recent court decisions as restricting their authority to take substantive action beyond minimum state provisions.

Towns have no authority below mean high water and have no specifically delegated authority to reject proposals due to adverse environmental impact. Better use of available local controls could be made, however, if towns had access to state opinion regarding project impacts prior to initiation of the local review process.

CRMC has attempted to rationalize state and local objectives via harbor management and SAM planning. In the Red Book, for example, CRMC established municipal harbor regulation whereby harbor management plans would go through a full Council review under Category B procedures before promulgation. In the SAM plan for Providence Harbor the Council set priorities for shoreline management in all of the Upper Narragansett Bay communities and established four general goals for improving Providence Harbor. In order to provide clear guidance with regard to plan implementation, the Coastal Resources Center assisted the Council in articulating 11 specific policies for waterfront use and recreation in the Upper Bay. Despite these policies and CRMC's assent authority over municipal harbor plans, the primary control over the development of waterfronts is municipal zoning, and CRMC water use classifications generally follow municipal zoning patterns.

In developed areas, in particular, CRMC has attempted to use SAM plans to address controversial issues and issues of intense statewide interest while accommodating local authority over land use. By working in the pro-active SAM plan preparation process, CRMC can move toward coordination of long-term local and statewide planning while making its comprehensive goals and objectives for the Upper Bay more palatable to the affected communities. This approach diverges from that utilized in special area planning in less developed regions, where a stated

purpose is to designate the existence of resources so as to determine what local zoning changes are needed in order to accomplish common goals of CRMC and the community.

Fundamentally then, state agencies, including CRMC, are unwilling to pass favorably on an application which would be rejected locally, and are wary of appearing to intrude on the carefully guarded land-use control purview of local jurisdictions. As a result, CRMC generally has authority to establish more stringent permit conditions than DEM or towns, but rarely if ever *exercises* its authority in such a way as to test the land-use jurisdiction of a local government.

Recommendations

***Revise CRMP regulations to specifically broaden jurisdictional coverage to provide for override of local zoning authority where resources of statewide concern are held in the public trust and are affected by land use. The jurisdictional definition should provide CRMC authority as necessary to protect coastal ecosystem function, and to ensure long term resource viability. As such, planning, management, and regulatory jurisdiction should encompass areas as defined by the law in its broadest sense, based on the statements of intent in the CRMC enabling legislation.

COUNCIL DECISION-MAKING AND INTERACTION WITH CRMC STAFF

Findings and Concerns

The management structure of CRMC is unusual and contributes to the agency's difficulties in taking a pro-active role in resource planning and management. According to staff interviewed, only 9 of the 17 Council members play an active role in agency activities. Members serve as volunteers, and have other professional responsibilities, so that only retired Council members are able to participate fully in daytime subcommittee deliberation and review.

Although some Council members have educated themselves as to the principles of coastal zone management, members' appointments (except for ex-officio members) are not based on technical qualifications. Because no forum exists for staff to work directly with the Council in evaluating technical aspects of project review, and because staff must present evidence as "witnesses" before the Council, decision-making has tended to be unpredictable, and has sometimes reflected individual members' biases rather than a balanced review of scientific evidence.

The subcommittees themselves have no set charge established by regulatory language. Although staff made an effort in 1987 to rationalize subcommittee jurisdiction, formal allocations have not been made. Projects frequently fall within multiple subcommittee jurisdictions, and must be reviewed sequentially. Separate reviews, however, serve a more procedural than technical purpose, as the same Council members serve on multiple subcommittees.

Subcommittees are not supported by specifically assigned technical staff. Assigned staff could concentrate their efforts on working with local governments in

the issue areas addressed by most of the subcommittees, and could coordinate implementation of SAM plan objectives.

Recommendations

*****Establish specific charters, jurisdictional responsibilities, and program implementation work plans for subcommittees. Assign staff to planning and management within subcommittee jurisdiction. (See SAM plan recommendations, below.)**

****Develop a formal training course program for all Council members, regardless of length of service, to be successfully completed before a member may vote with the Council. Require completion of periodic update and review courses to familiarize Council members with related program and policy developments at the state and federal levels.**

****Establish a selection review board, composed of academics and members of the Land Use Impacts Council recommended in Chapter 1.3, to establish qualification criteria for Council membership and to review the qualifications of proposed Council nominees.**

****Consider establishing an outside administration-level academic review board which could provide policy guidance, technical assistance to staff, and expert input to contested CRMC impact evaluations. For example, the review committee could provide written determinations where a staff analyst felt that a project was of a unique character not amenable to standard evaluation procedures, or raising issues not adequately addressed by existing written policy. For public projects involving funding deadlines or public projects involving health and safety issues, the review committee could meet with representatives of the public agency or municipality and the analyst to clarify issues, adjust project plans to mitigate coastal resource impacts, or set schedules and deadlines for compliance with specified pollution control measures or other impact mitigation procedures.**

PROJECT EVALUATION

Findings and Concerns

Land Use Evaluation Tools and Review Criteria

Although the Redbook lists general use categories which are considered preferable in water area types, few uses are prohibited outright except in conservation areas, and stated preference criteria are broad and, in general, lack specificity. For example, "water dependent and water-enhanced commerce, including business catering to tourists," is listed among the highest priority uses of Type 5 Commercial and Recreational Harbors, a categorization which could accommodate many uses which effectively limit public access to the shoreline. Because CRMC has interpreted its authority over land use narrowly, water use designations should be as clear as possible in order to limit degradation.

Specifically stated preferences for water-dependent uses which established formal suitability categories would not only provide improved

predictability to applicants and discourage submission of inappropriate applications, but would give support to municipalities in developing harbor management plans and establishing marine or waterfront zoning districts.

Flood hazard area management could provide a valuable tool to CRMC in relating land use to resource protection in coastal areas. However, the Council has not gone beyond the minimum federal requirements in recent years, and tracks the state building code requirements for construction and restoration.

Recommendations

****Revise development project review procedures to state specifically that strict preferred consideration will be given to those forms of commercial activity which clearly are water dependent and which are primarily oriented to the coastal region. State clearly the forms of commercial activity preferred, including port terminals and wharves, commercial fishing, fish processing and distribution, protection of scenic vistas and access for the public, oceanographic research, marinas and boatyards, etc.**

*****Establish numerical criteria to use in evaluating water dependent uses which establish a balance among uses and prevent concentration of "dockominiums" and other facilities which limit public access. Establish height and lot area coverage limits to promote visual and physical access to the shoreline.**

*****Revise regulatory standards establishing flood hazard area requirements to forbid construction of structures, infrastructure, or other facilities in coastal high hazard areas which involve any pass-through or application of federal funding, funding assistance or guarantee, including acquisition of loans from federally-insured financial institutions.**

****Revise CRMP and regulations to prohibit reconstruction of damaged infrastructure in coastal flood hazard areas as stipulated by federal executive orders.**

****Work with towns to develop large scale graphics which can be used as zoning overlays to reference individual lots and their specific land development constraints. In the individual published plans, foldout pages should be provided which detail tributary ponds and streams and provide as much detail as possible at an understandable and useful scale.**

****Include in the plans specific recommendations to towns as to local requirements which can be imposed to mitigate the impacts of development on undersized lots, including: establishment of strict minimum fifty-foot buffer zones, limitations on lot coverage (building and impermeable surface), requirement for use of a separate septic field for specific household appliances, mandatory ISDS maintenance and repair requirements; etc.**

*****Clearly specify the manner in which local zoning and planning policies and ordinances should be modified to reflect the objectives, intent, findings, and regulatory needs articulated in the CRMP. Make strict, specific regulatory provisions for control of development, particularly in areas where substandard**

lots platted prior to the advent of contemporary zoning criteria create the potential for concentrated development in hazard areas or in areas developed beyond carrying capacity.

****Revise CRMC regulations to state specifically under what conditions flood plain analyses will be required, referencing: a) effect on potential floodplain areas; b) effect on existing watershed flood storage capability; c) effect on flood hazard vulnerability of surrounding development.**

Water Use Area Review Criteria

With regard to resource protection, CRMC uses water quality certifications in evaluation of development effects, but has little real authority to prohibit development based on water quality impacts, except in cases where an activity is specifically prohibited in the water type at issue. If a water quality certification can be obtained, CRMC has little ability to deny a permit on water quality grounds, because it is not involved in water quality monitoring activities.

Applicants proposing new point discharges in Type 1 Areas must demonstrate that "no reasonable alternative to the discharge exists, and that no significant adverse impact to the receiving waters will result," but criteria for measuring effects are not specified. In Type 1 and 2 Waters, mitigation requirements are not specified. Similarly, although cumulative impacts of runoff are stated to be "of particular concern" in Type 1 waters, methods of measuring or addressing those impacts are not outlined.

Recommendations

CRMC and DEM need to develop a water quality based approach to pollution control and project evaluation, consistent with the objectives articulated in the special area management plans. In order to address non-point source impacts in a cohesive manner, it is necessary to develop specific programs to achieve reductions in pollution discharges and improvements in the water quality of tidally influenced rivers and other Bay areas affected by non-point source pollution.

*****Working with DEM, develop a water quality characterization process to be used to link biological integrity with effects of present use and potential use to the maximum extent possible. Waste load allocations and effluent limits should be established to coordinate the simultaneous imposition of point source discharge limits and non-point source controls.**

*****Use characterization results to establish detailed water quality goals to guide non-point pollution efforts in specific areas and to develop a planning process for these selected areas which clearly links defined water quality goals to non-point pollution control programs and requirements. Guidelines should be developed setting specific standards to govern the siting and design of development so as to consider water quality concerns as a basis for siting, operation, and maintenance.**

*****In cooperation with DEM, develop a pre-development and post-development water quality monitoring program for use in critical watershed areas and estuarine waters. The agencies should jointly define how water quality**

measurements will be used in evaluating the adequacy of stormwater, erosion, and sedimentation control measures and facility designs. Similarly, they should define how water quality measures will be used in measuring adequacy of facility performance through time, and in initiating enforcement procedures where maintenance schedules are not adhered to and non-point source controls are allowed to become insufficiently effective.

*****As an aspect of the preceding responsibility, a two-part management oriented water quality standard should be established in which each agency responsible for regulating activities with a potential for contaminating waterbodies would set both a preventive action limit and an enforcement standard. The preventive action limit would be a small fraction of the companion enforcement standard; violation of this limit would trigger an examination of possible responses by the administrative body having jurisdiction over the source. Depending on the actual or potential seriousness of the contamination, the agency could require site-specific remedial action, revise agency rules to address the problem, or take no action. Violation of the enforcement would trigger an immediate enforcement action against the violator.**

****Prepare a geographically-based mapped record of potential cumulative effects to be used in coordination with DEM permitting and wasteload allocation.**

Planning

As outlined above, project permit applicants and Council Staff are to be guided by elements of the Rhode Island CRMP, applicable SAM plans, and the State Guide Plan Overview. Land use guidance provided by the State Guide Plan provides valuable support to CRMC in meeting its ecosystem management mandate. In consideration of this program linkage, CRMC management procedures stipulate that the Division review applications to ensure their conformance with the objectives of the State Guide Plan.

In fact, coordination between the Division of Planning and CRMC is incomplete, although the Division receives nearly ten percent of the federal coastal program implementation funds which come into the state. A Division planner reviews a portion of CRMC applications, but his comments are not binding on CRMC, and he is not included in subcommittee or staff review of the applications. CRMC can issue an assent before comments from the Division are received or reviewed. The Division has no specific authority to provide technical evidence in Council hearing proceedings, nor to rebut incorrect evidence which may be presented by a developer or a town.

Similarly, with regard to A-95 review, the Division's comments are accorded little formal weight in permit evaluation. The Division's broad role in outer continental shelf development planning gives it much valuable expertise to contribute in evaluating broad impacts of federal facility siting issues.

Recommendations

****Revise applicable regulations and procedures to provide for full incorporation of Division of Planning comments at the subcommittee review stage of application assessment. Appoint an appropriate technical staffperson and an appropriate community affairs staffperson from the Division of Planning to serve as members of each**

subcommittee, to promote the legislatively mandated consistency of CRMC actions with the State Guide Plan.

Inclusion of Applicable Development in the Permit Review Process

Currently, the state building code does not stipulate that an applicable CRMC assent must be obtained before a municipal building permit may be issued. Although most building inspectors are cooperative with the coastal program, others are poorly informed regarding program jurisdiction, or do not consider enforcement of its jurisdiction a priority.

Developers confirm that many developments affecting coastal features or buffer areas proceed outside the permit process. During the past year, delays in processing CRMC assents have been significantly reduced, so "avoidance of delay" cannot now be viewed as a more convincing motivation than a desire to circumvent the process.

Although failure to obtain a permit generally results in a sequence of violation notice, ex-post review, and consent agreements, applicants avoid important aspects of the permit conditioning process, avoid implementing non-point source controls until the construction-related runoff and sedimentation damage has been done, and may never be required to complete full restoration.

Recommendations

*****Working with the RI Building Commission, revise the state building code to provide that CRMC assent conditions must be complied with before an occupancy permit may be issued by local building inspectors.**

The Permit Review Sequence

Because the order of permit review begins at the town level, proceeds to DEM and then finally to CRMC (as advised by the Division of Planning), permits may never reach CRMC, or may have been conditioned or approved in ways which are inconsistent with the ecosystem management mandate of the CRMP, or which are not conducive to large scale problem resolution.

Applicants find that variances, conditions, or special exceptions issued pursuant to one permit granting agency may be unacceptable to another. Flexibility of response is constrained, even though expert opinion unavailable to municipal agencies in the early stages of the process is introduced later at the state level. CRMC, at the end of the permitting process, is frequently placed in the position of requiring substantive changes in plans which have emerged from a review process involving months of hearings before various bodies. Once municipal approval has been obtained, the ability of state agencies to work with the developer to mitigate potential impacts is severely constrained, though agencies such as CRMC may have the broadest powers to consider environmental impacts (Olson and Lee, 1984).

With regard to local impacts, building and subdivision permits are obtained from a range of town commissions; approval for on-site sewage disposal systems is granted by DEM's

ISDS Section; Water Quality Certifications and Wetlands permits are granted via DEM's Division of Water Resources and Division of Groundwater and Freshwater Wetlands approvals-- all prior to request for a CRMC approval. As an example of inconsistency, DEM has traditionally used criteria for evaluation of ISDS siting which were based on system function, rather than on potential environmental impacts (corrections have been proposed by the ISDS Task Force).

As to broader impacts, dredged material disposal provides a useful example. The Corps of Engineers, EPA, and DEM respond to the requirements of Section 404 of the Clean Water Act and require compliance with water quality standards, while CRMC jurisdiction is defined by its state-level enabling legislation. When DEM denies water quality certification of disposal permit applications, citing its non-degradation policy with respect to classified waters, applications do not reach CRMC, where a resource management mandate encompasses evaluation of dredge disposal needs in the state.

Recommendations

*****The permit review sequence should be revised to provide that applications are submitted first and simultaneously to CRMC and DEM Freshwater Wetlands, with copies of applications to the recommended local environmental officer, who may provide advice as to the completeness of the application, and discuss town requirements with the applicant. The towns should review the applications following CRMC, so that local officials can have the benefit of state-level analysis of impacts.**

MANAGEMENT INITIATIVES

Special Area Management

Findings and Concerns

Although each Special Area Management Plan has been developed in a unique manner and has moved on an individual path toward implementation, some common problems have emerged. Although all of the individuals interviewed during the course of the present research effort concurred that special area management techniques can be useful in estuarine management, several individuals expressed concern regarding the pace and direction of SAM plan implementation. Concerns voiced by members of the committees and working groups which were instrumental in preparing and monitoring implementation of the plans include:

CRMC has not taken an aggressive role in urging towns to undertake necessary revisions of local ordinances and by-laws to support the objectives of the SAM plans. This is partly due to lack of staff available for outreach activities, and partly due to a reluctance to intrude into town jurisdiction.

Nor, as in areas outside SAM plan purview, has CRMC moved to encourage and support vigorous protection of floodplain areas and coastal high hazard areas except by revising SAM plan regulations to incorporate procedures established by applicable post-hurricane mitigation plans.

Currently, only one staff planner is assigned to provide support in implementation of special area management plans. Sufficient staff need to be available to address the specific tasks of working with the recommended committees assigned specifically to the implementation of each SAM plan, with the Small Estuaries Subcommittee, other CRMC committees, and the Citizens Action Committees to ensure effective implementation of the plans. A voluntary citizens group such as the Citizens Action Committee cannot be relied upon to coordinate meetings and activities among officials of involved towns, academics, other government agencies, and additional public and private interests as necessary to implement the plans.

Although CRMC has used the SAM planning process to foster improved communication with DOT, **neither CRMC nor DOT have been uniformly successful in ensuring contractors' compliance with stated policies and prescribed facilities plans.** The difficulties are similar to those encountered by the Freshwater Wetlands Section of DEM, and are discussed in detail in the related chapter on Stormwater and Sediment.

A close working relationship has not been developed between CRMC, DEM, and the towns in ensuring that lands designated as being "of critical concern" in the SAM plans are given high priority for acquisition under the Heritage Bond funding program and other land acquisition programs.

Recommendations

*****Use the flexible problem-solving orientation of the SAM planning process to place increased emphasis on watershed-based planning and management, and to foster development of regional inter-community cooperative programs.** As the increased cooperation among adjacent towns with regard to wastewater planning has shown, joint efforts can be effectively undertaken.

In order to use special area management to best effect in addressing non-point source control, some clarifications in policy and management procedure are necessary:

****Clarify goals articulated in the SAM plans to provide specific statements regarding priorities, geographically-based initiatives and changes needed, and to clearly articulate objectives with regard to governance, institutional design, and implementation. For example, include goal statements in the SAM plans to:**

- promote specific patterns of land use that protect remaining open space, protect public access to the shoreline, and maximize potential for resource protection and water quality enhancement;
- preserve the remaining natural flood protection barriers and protective coastal features for the general health, safety and welfare;
- prohibit development of infrastructure or reconstruction of damaged infrastructure in coastal flood hazard areas as stipulated by federal executive orders;
- establish specific means to promote inter-agency and inter-governmental cooperation and coordination of planning, regulatory, and other program efforts

with respect to the SAM planning area (certain measures were proposed in the Providence Harbor SAM Plan).

*****Establish a specific subcommittee, supported by a sufficient technically qualified staff, to implement each of the SAM plans.** The committee would review and submit recommendations to the full Council on all Category A and B applications originating or affecting the area covered by the plan to assess conformance with the goals of the SAM plan as well as the rules embodied in the CRMP. An appropriate technical staffperson and an appropriate community affairs staffperson from the Division of Planning would serve as members of the subcommittee, to promote the legislatively mandated consistency of CRMC actions with the State Guide Plan by providing technical assistance to towns in assimilating available scientific information, and by appearing regularly in an advisory capacity at town meetings and hearings. CRMC needs to support towns in instituting necessary moratoria so as to address needs identified as the plans were developed.

****Develop and clearly articulate specific work plans:**

- detailing the SAM plan's stated initiatives;
- defining specific steps to be taken in implementing each of the policies and objectives of the plan; and
- specifying the units, agencies, and groups which will be responsible for implementation (or for assisting in specific aspects of implementation) of all categories provided in the "management regulations and initiatives" categories of the plans. (A first year work plan was outlined in the Providence Harbor SAM Plan)

****Articulate and make public specific plans for the allocation of SAM planning staff resources in furtherance of specific workplan tasks, and for staff coordination with the Council, other review committees, and the public.**

*****Establish specific means to promote effective coordinated review of permit applications and planning proposals.** See Strategy for Review of Cumulative Effects, in related chapter on Laws and Programs.

****Work with DEM, the Division of Planning and the towns to coordinate public acquisition programs, land donations, public purchase of development rights and conservation easements, voluntary deed restrictions, and other such land conservation tools so as to develop coherent resource protection programs in SAM plan areas.**

*****Revise SAM plan regulatory language to specify that all major road, highway, and bridge construction or reconstruction projects shall be reviewed by the CRMC from the initial stages of planning.** CRMC should revise applicable language to specify in legal terms how state and town agencies are to proceed in obtaining CRMC input, what notification procedure and environmental impact review procedure will apply, and how public input will be addressed.

****Using Narragansett Bay Project research results and other available data, and building on the rationale employed in special area management techniques, develop consistent methods**

to define pollution control goals with increased precision, based on use and evaluation of work plans.

****Review Special Area Management plans every two years (at a minimum) to measure progress toward meeting specific goals and objectives specified in annual work plans.**

Buffer Areas

At present, CRMC's policy with regard to imposition of buffer areas is insufficiently clear. Citizens, developers and agency staff familiar with the program stated that decision criteria regarding buffers were unspecified, negotiating flexibility too broad, scientific evidence insufficiently applied in deriving buffer dimensions, and maintenance and protection responsibilities unstated. Especially with respect to non-point source impacts, these perceived program implementation problems are of concern. If the inverse condemnation issue is contributing to CRMC's difficulties in establishing adequate buffer areas, then the need for regulatory clarity is further emphasized. Although recommended buffers take precedence over set-backs as a matter of CRMC practice, this policy is not stated in the Red Book.

Recommendations

*****Revise CRMC regulations to include clear policy statements and review criteria to be applied to proposed development in coastal areas, regarding:**

- a) definitions of applicable buffer area jurisdictions and all areas affecting buffers including areas: within 50 feet of the edge of a marsh, pond or bog; within 100/200 feet of tidally-influenced riverbank wetlands depending on the size of the watercourse (as consistent with Freshwater Wetland regulations);
- b) definitions of the term "minimal or no disturbance" to be allowed in such areas;
- c) specific means and methodologies to be used in deciding which applications will be subject to review of cumulative effects; what means and measurements will be used to evaluate cumulative effects; and what mitigating measures will be required. Criteria should include clear standards of evaluation regarding hydrologic modification, loadings of sediment/turbidity, and input of toxics which would facilitate evaluation of cumulative effects. (Methodologies currently applied in Maine, in Falmouth, Massachusetts, and in other jurisdictions).
- d) specific technical issues to be considered in drawing distinctions between Category A and Category B Assent applications with regard to work that may affect the setback area of coastal buffer areas or may affect floodplains. Technical criteria should include clear standards of evaluation regarding hydrologic modification, loadings of sediment/turbidity, and input of toxics which would facilitate classification of alterations and evaluation of cumulative effects.

Implementation of Non-point Source Controls

CRMC considers non-point source impacts in its permit evaluation process, and regularly requires use of specific control practices. Technical guidance and specifications are included in the Red Book, but these provide limited detail, and are not accompanied by

clear illustrations. Staff work with project designers to encourage installation of adequate practices on a case-by-case basis.

As in other aspects of its program implementation, CRMC does not have sufficient staff to make site visits as necessary to ensure proper design, construction, and maintenance of control structures, to measure their effectiveness over time, and to require remedial action as necessary.

Recommendations

*****Revise CRMC regulations to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding stormwater management planning, design and installation of best management practices, and maintenance and repair of facilities. Attach applicable stormwater controls and maintenance and repair provisions to all permits.**

*****Revise CRMC regulations to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding erosion and sedimentation control, design and installation of best management practices, and maintenance and repair of facilities. These technical requirements will be defined in the updated Rhode Island Sediment and Erosion Control Handbook, currently in preparation. Attach applicable erosion and sedimentation controls and maintenance and repair provisions to all CRMC permits.**

****In coordination with the Division of Planning and DEM, assist towns in developing wastewater management policies and plans (including mandatory ISDS upgrading), and in establishing wastewater management districts.**

****Work with DEM, the Division of Planning, and Conservation Districts to assist towns in developing comprehensive stormwater management and erosion and sedimentation control programs.**

COORDINATION AND CONSISTENCY

Findings and Concerns

Issues surrounding water quality permitting authority in the Bay itself are complicated. Because the Bay *as a whole* has not been designated as water quality limited, DEM has not used waste load allocations to translate existing criteria into discharge limits for permits. In a series of permit review procedures, CRMC and DEM have been at odds regarding application of discharge criteria. (CRMC overrode DEM three times in the early 1980's on the Hunt Chemical discharge permit, for example.)

DEM denies water quality certifications where degradation of classified waters is anticipated, but has not prepared guidance or evaluation standards to govern the certification process. Because designated uses are based on goals, rather than on existing conditions, and because clear evaluation

standards are not in effect, DEM often has significant political difficulty denying certification on the basis of incremental cumulative effects. Where freshwater wetlands are involved, the Freshwater Wetlands Act provides for a more comprehensive review of impacts.

As a coarse tool, then, the certification process is most effective when DEM can demonstrate that a change in designated use classification would be imposed by a proposed use (such as elimination of designated fishing use anticipated by the proposed siting of LNG vessel mooring facilities in open waters of the Bay in 1987). With small projects, DEM uses the certification process to require installation of erosion control measures, but cannot follow up on evaluated impacts, because certifications are merely attached to other permits issued by DEM or CRMC.

Because CRMC's water use and shoreline categories draw heavily from adjacent zoning districts established by municipalities, use designations may conflict with DEM designated use classifications. CRMC Types 3, 4, and 5 are not infrequently designated as SA and SB waters by DEM. Faced by the inconsistency, developers and municipalities have repeatedly challenged the original DEM designation process, claiming that designations were arbitrarily drawn.

Basically, the conflict turns on differences between program mandate and on jurisdictional inconsistency. DEM places program emphasis primarily on human health impacts of discharges to receiving waters, in that the SA designation identifies areas where harvested shellfish may be safely consumed raw, and the SB designation identifies safe swimming areas. CRMC's broad resource management mandate, on the other hand, encompasses potential ecological degradation as well as appropriateness of use. CRMC tends to interpret its jurisdiction narrowly, placing heavy emphasis on the need for support from local zoning.

Recommendations to RIDEM and CRMC

*****Revise permitting procedures and guidelines relating to SA and SB waters to ensure consistency of interpretation between the two agencies. The revision process should be utilized as an opportunity to develop a framework allowing for significantly strengthened consideration of cumulative effects, as recommended in other sections. A water quality characterization process should be used to link biological integrity with effects of present use to the maximum extent possible. Waste load allocations and effluent limits should be established to coordinate the simultaneous imposition of point source discharge limits and non-point source controls. Guidelines developed should include specific standards to govern the siting and design of development and so as to consider water quality concerns as a basis for siting, operation, and maintenance.**

VARIANCE PROCEDURES

Findings and Concerns

In numerous coastal areas of the Bay, variances and special exceptions are currently issued by CRMC to allow construction projects which are not in conformance with stated

coastal buffer requirements, which do not adequately control non-point source impacts to the Bay watershed, and which may be incapable of sustaining the effects of coastal storms.

No specific standards govern approval of variances. A recent effort on the part of the staff to develop a specific protocol to govern review of variances was not supported by the Council. Section 120 of the Red Book provides five general policy criteria to be used in granting variances from a regulatory standard:

- 1) The proposed alteration conforms with applicable goals and policies in Parts Two and Three of the CRMP
- 2) The proposed alteration will not result in significant adverse environmental impacts or use conflicts
- 3) Due to conditions at the site in question, the standard will cause the applicant an undue hardship
- 4) The modification requested by the applicant is the minimum necessary to relieve an undue hardship
- 5) The undue hardship is not the result of any prior action of the applicant

Variance review procedures have been an issue of considerable concern for some time. Although abutters and other interest groups requesting notification are advised of subcommittee variance reviews, review hearings are subject to the same shortcomings regarding presentation and evaluation of evidence as are other CRMC hearing proceedings. Substantive findings prepared by staff and by outside technical professional reviewers are accepted only as evidence presented by "witnesses." Again, interest groups are put in the position of amassing and presenting evidence in support of staff findings.

Recommendations

To protect the integrity of the coastal program, support local government resource protection issues, provide accountability to the public, and improve predictability for applicants, **it is critical to provide clear guidance as to the circumstances under which variances and special exceptions will be reviewed, granted, or denied, and the conditions to be attached to approval.**

****Consider establishing a point-based system for initial review of variances and special exceptions.** (See the model described in the related Chapter 2.1 on ISDS.) The system should define clear conditions under which variances will *not* be considered (where a *presumption* would be made that a defined action would substantially endanger public health and environmental quality).

*****Establish a clear set of criteria, to be included as regulatory language in the Red Book, which will be used in evaluating variance applications.** The criteria should address all of the following: a) soil type; b) existing drainage characteristics of the site which pose development constraints, and existing drainage alterations; c) location in a floodplain A zone; d) location in a floodplain V zone; e) depth to groundwater and impervious layer; f) slope; g) lot size; h) width of buffers to coastal features; i) type of development and flows of stormwater runoff; j) sewage effluent projected; k) erosion and

sedimentation potential projected; l) existing drainage alterations; m) availability of public water and sewer; and n) location of lot with respect to coastal features, habitat resources, or other vulnerable areas. The rating system should be set up in such a way that sites which prove suitable for siting in other respects than that from which a variance is sought would be considered more favorably than those sites in which several site conditions are marginal or unfavorable.

*****Establish conditions to be attached to variances and special exceptions with regard to inspection schedules, requirements for maintenance of non-point source pollution controls (and responsibility for necessary maintenance), alteration and/or change of use restrictions to be applied, and conditions under which the variance would be revoked.**

****Require that no variance will be granted for new development in a flood hazard area or for enlargement of an existing development which increases the flood or storm damage potential to other structures within the floodplain.**

****Set up a variance advisory board to provide input to the Subcommittees.** The board should include representatives from Conservation Districts, DEM (including Fish and Wildlife), the Division of Planning, the Soil Conservation Service, local planning staff or environmental officers, and outside professionals with expertise in public health/environmental issues.

****Forward all requests for variances and special exceptions made to CRMC (before action is taken) to the appropriate Town and WWMD authorities so that consistency with WWMD and Town policies can be assured if Town policies are more stringent than the minimum state provisions. Forward all requests for variances and special exceptions relating to water quality so that potential impacts can be evaluated as part of the joint agency effort to improve response to cumulative impacts.**

***Forward copies of CRMC actions on variance requests, and conditions attached, to the appropriate Town zoning, planning and wastewater management authorities so that data can be effectively incorporated into the town records, and so that permits can be attached as deed encumbrances.**

*****Clearly place the burden of proof on applicant to demonstrate that approval of a variance will not result in a reduced level of protection of environmental quality or public health than that afforded by strict application of regulatory standards. Further, require that the applicant furnish proof that enforcement of the regulations would do manifest injustice.**

ENFORCEMENT

DEM's Division of Enforcement was assigned the responsibility for enforcing the laws and regulations of the Coastal Council, according to Section 46-3-7 of the Council's enabling legislation. The Division's Conservation Officers, who also enforce DEM's shellfish regulations, are responsible for taking all CRMC enforcement actions which involve arrests. Under an informal agreement, the Conservation Officers assist the CRMC enforcement staffperson in other enforcement efforts as time and resources permit. The legal jurisdiction of each agency with respect to enforcement needs clarification, particularly where water quality impacts form the basis of enforcement actions.

General enforcement capability at CRMC has long been a subject of controversy. When responsibility for coastal zone management was transferred from DEM to CRMC, enforcement responsibility and authority remained with DEM. CRMC staff limitations are such that insufficient resources are available for follow-up to ensure that permit conditions are met, and that applicants comply with permit conditions in the long term. A large back-log of old violations await enforcement action. Given the maintenance requirements of non-point source controls, lack of enforcement capability will create increasing program vulnerability as requirements for BMP installation are attached to permits. The Executive Director acknowledges that enforcement capability is inadequate to meet current needs.

Section 46-23-16 gives the Council authority to grant permits, licences, and easements for any term of years or in perpetuity, allowing permit duration to be established so as to provide for consistent compliance with conditions as a condition of reissuance. Lack of enforcement staff severely limits the utility of this provision. By a recent rule change, the Director of CRMC was delegated the enforcement authority which had previously been reserved for the Council, but authority is still insufficient to create adequate incentive for compliance among potential violators.

Three categories of recourse are available to CRMC in responding to violations:

- 1) If the violation is considered "minor," any Council or staff member can issue a notice of violation to the landowner. This notice is essentially a warning and carries no legal power. A copy of the notice is filed as a CRMC record.
- 2) If the violation creates "significant environmental harm" constituting a violation of an Assent, a cease and desist order may be issued by CRMC. If the violator fails to remedy the situation, a subpoena may be issued to require the violator to describe his/her cause for failing to comply. In "many cases," according to CRMC staff, subpoenas are issued for activities which have proceeded outside the permit process. In such cases, the violator is required to go through the permit process after the fact, and CRMC applies permit conditions as feasible.
- 3) CRMC may also require restoration under a cease and desist order. If a violator refuses to comply, CRMC may seek criminal prosecution through the Attorney General's Office, or may bring civil action through its outside legal representation.

The real enforcement authority provided by these mechanisms is limited, for the following reasons:

- a) Only one full-time Council staff person is assigned to enforcement;
- b) CRMC, unlike DEM, is not empowered to impose administrative penalties or fines on violators;
- c) CRMC, unlike DEM, is not empowered to register violation of permit conditions or program requirements as deed encumbrances;

- d) CRMC regulations, except for certain floodplain building requirements, are not included as an attachment to the state building code;
- e) CRMC regulatory language does not specifically prohibit issuance of a municipal building permit until a completed CRMC assent has been obtained; and
- f) CRMC is not empowered to undertake restoration work (or to hire an agent to perform restoration work) and back-charge the violator.

With the exception of a) and f) above, all of the itemized deficiencies are being addressed by bills submitted in the current session of the Rhode Island General Assembly.

The Attorney General's Office has also submitted a legislative package providing for significant revisions of enforcement practice. The legislation broadens the definition of violations under which enforcement actions may proceed, provides increased enforcement authority to staff, allows municipal police to take enforcement actions, and provides for citizens suits.

To achieve consistency among state regulatory remedies, CRMC should have authority to issue administrative fines, and to establish financial penalties of sufficient magnitude to both discourage unpermitted activity and support enforcement efforts.

Similarly, attachment of permit conditions as deed encumbrances can be an extremely useful enforcement mechanism if supported at the local level. Section 2-1-22 (f) of the Amended Freshwater Wetlands regulations states that "notice of permit and notice of completion of work subject to permit shall be eligible for recordation under Chapter 13 of title 34 and shall be recorded at the expense of the applicant in the land evidence records of the city/town where the property subject to permit is located, and any subsequent transferee of such property shall be responsible for complying with the terms and conditions of the permit."

This provision is extremely important, in that:

- a) public notice is provided in at least a limited manner;
- b) responsibility for maintenance of permit conditions is established, along with a mechanism for transfer of responsibility;
- c) a reference showing applicability of the wetland regulations is made available to building inspectors, so that compliance with specifications can be assured at the local level; and
- d) DEM can take action in situations in which violations go uncorrected.

Town building codes should specifically reference all CRMC requirements, and should require as a firm provision that occupancy permits may not be issued until all applicable state permit conditions, including CRMC permit conditions, are complied with.

CRMC should have authority to undertake restoration work at the violator's expense, but the authority should be established in such a way as to assign the violator liability, rather than CRMC. Liability considerations and administrative complexity have proven an obstacle to DEM's use of restoration authority. (See discussion of DEM's authority under Freshwater Wetlands in Chapter 2.3.)

Recommendations

****Establish a local enforcement and review fee to be required of all permit applicants. The fee required should be commensurate with the size of the project and with potential watershed impact. The funds collected should be passed through to the town in question to support hiring of local officials responsible for review of CRMC and other environmental permit requirements. Pass-through of funds would be contingent on CRMC and Wetlands Section spot-checks of permit compliance consistency among town land evidence records, state permit requirements, and evidence in the field.**

*****In permits, ensure that responsibility for maintenance of permit conditions is established, along with a clear mechanism for transfer of responsibility at the time of a change in ownership.**

*****In cooperation with the State Building Commissioner, develop an administrative mechanism to ensure that building inspectors or other town officials (such as environmental officers) obtain the land evidence records on all relevant properties to verify that wetlands permit application data is fully recorded. Develop a permit bonding fee or other legal mechanism to make the inspector or the town in question liable for assuring compliance with stipulations before a building or occupancy permit is issued. Because severe non-point source pollutant impacts are associated with project construction, this program linkage is crucial.**

STAFFING

Although CRMC staff operate efficiently, staff limitations are such that insufficient resources are available for follow-up to ensure that permit conditions are met, and that applicants comply with permit conditions in the long term. Given the maintenance requirements of non-point source controls, lack of enforcement capability will create increasing program vulnerability as requirements for BMP installation are attached to wetlands permits. The Executive Director acknowledges that enforcement capability is inadequate to meet current needs.

Trained enforcement officers on the CRMC staff need to be available to undertake inspections and other field enforcement duties. Use of technical personnel in this capacity without the support of officers has long been a subject of debate with DEM wetlands enforcement, and reliance on technical personnel should be avoided. Increased "capture" of applicable development activities will increase the need for technical staff devoted to review and conditioning of permits.

Recommendations

*****Full implementation of non-point source control practices will require more than doubling the present engineering staff of CRMC, because of the need to undertake site-specific design and inspection surveys to ensure**

proper use of design criteria. The inspection process is expected to be labor intensive, and to very heavily involve engineering expertise.

Hire technical planning and resource management staff to support to full implementation of the SAM plans and to undertake the recommended subcommittee activities, necessary outreach activities, and provide technical assistance to communities as needed.

LEGAL SUPPORT

For some time, the lack of staff legal support at CRMC has been a subject of concern. Members of the advisory committees involved in preparation of the SAM plans, in particular, have stressed the need for development of an in-house legal department in CRMC where attorneys would be exclusively concerned with promoting the objectives of the CRMP. Several individuals interviewed during the course of this research effort expressed concern that a retainer arrangement with a general practice law firm tends to place the Council in a position which involves exclusive reliance on outside opinion in choosing enforcement actions and strategies.

In addition, CRMC's ecosystem management and protection mandate involves the Council and staff in issues of great technical complexity. Because of the role which technical issues play in jurisdictional determinations, and in evaluation of both permit conditions and adequacy of compliance, staff need to work closely with attorneys on a regular basis.

At the same time, the attorneys on retainer who argue coastal resource protection issues in administrative hearings and judicial proceedings depend heavily upon technical advice provided by staff in presenting and responding to technical questions. **If in-house legal staff were devoted to exclusive duty within CRMC, to work in concert with retained legal support, enforcement efforts could be effectively strengthened.**

Recommendations

****Hire in-house legal staff to strengthen CRMC enforcement capability, and to enhance enforcement coordination among agencies.**

3.2 IMPLEMENTATION OF THE NATIONAL FLOOD INSURANCE PROGRAM AND OTHER HAZARD MITIGATION INITIATIVES

Introduction

The National Flood Insurance Program (NFIP) provides basic flood hazard data, and a flood hazard management framework for all flood-prone communities in the United States. The original conception of the NFIP was that flood insurance coverage and other benefits would be provided in a two-staged program to local communities conditioned on the progress communities made in undertaking certain flood hazard management steps, and subsequently implementing flood hazard management programs. In theory, the floodplain management program can be used as a valuable land-use management tool by local communities. In addition, many of the flood hazard management practices anticipated are directly related to non-point source control---particularly to management of stormwater and control of erosion and sedimentation. The following paragraphs outline the program basis of the NFIP, as its policies were originally conceived.

In communities participating in the NFIP, federally regulated lending institutions must require that purchasers of property in designated flood-prone areas purchase the appropriate flood insurance policy as a condition of obtaining a mortgage loan. Flood insurance policies are made available at federally subsidized rates, rate levels being dependent on the status of a particular community in the NFIP.

In the Emergency Program, mitigation measures required of communities relate to the issuance of building permits and certain development activities. Until detailed flood hazard maps are available from the Federal Emergency Management Agency (FEMA), communities are required to develop a process for case-by-case consideration of developments in known floodprone areas. Communities are encouraged to use historical evidence in assembling the best available data on flood boundaries and elevations.

When a community moves to participation in the Regular Program, more stringent floodplain management measures are required, which are tied to the amount of information provided by FEMA. These include land use requirements in areas of high hazard. In such areas, new development should be restricted and existing development, when damaged, should be flood-proofed and up-graded to applicable building code specifications, or removed.

Responsibility for implementation of the NFIP rests primarily with local communities. The local government's role is to adopt and implement the variety of zoning and building requirements which establish the condition of participation in the NFIP. (Management requirements are established for zones defined according to degree of flood hazard.) In that regard, zoning and planning boards and municipal building departments have continuing enforcement responsibilities. The chief executive officer of the municipality is FEMA's principal contact in its monitoring of a community's implementation of the NFIP. FEMA has encouraged communities to develop community standards more restrictive than those of the NFIP.

On the state level, where state properties and buildings are concerned, agencies must either comply with the floodplain management requirement of the relevant local community or develop their own requirements consistent with the floodplain management objectives of

the NFIP. States also provide enabling legislation allowing towns to undertake floodplain management initiatives required by the NFIP.

State legislative bodies and agencies may also require more restrictive practices than the NFIP by enacting and implementing laws to protect barrier islands, wetlands, and other coastal or inland watershed resources that serve as flood hazard buffers. Regulatory measures in some states virtually prohibit construction in the 100-year floodplain, by severely limiting construction and extension of infrastructure. Many states also provide standard elevation requirements that account for storm conditions or technical limitations in the flood maps.

Findings and Concerns

Introduction

Several elements of the existing inter-governmental hazard mitigation framework provide bases for control of runoff, erosion, and sedimentation, and for imposition of siting controls which could significantly reduce impacts on receiving waters. For example, the NFIP emphasizes that siting development so as to contribute to or perpetuate flood hazard should be strictly avoided. The federal regulations require communities to control drainage so as to minimize downstream flood hazard, and to control erosion and sedimentation so as to eliminate loss of flood storage capacity. In addition, policies and Executive Orders issued at the state and federal levels prohibit development of infrastructure in hazard-prone areas except under special circumstances, and encourage land management initiatives which minimize hazard.

As a condition of the disaster assistance agreement made between Rhode Island and FEMA following Hurricane Gloria, a Hazard Mitigation Task Force was formed to address mitigation policy. The Salt Pond Area Hurricane Preparedness Plan, developed via the special area management process, was extended through the preparation of the state's Post Hurricane Mitigation Plan (1986) and Hazard Mitigation Plan (1987). These plans recommended many legislative actions, regulatory measures, and program revisions of importance in non-point pollution control.

NFIP Participation

All construction requirements of the NFIP were incorporated into the state building code in 1977, as required by a major federal regulatory revision of 1976. All 39 Rhode Island towns have at least generally incorporated federal floodplain management requirements into zoning controls. Local building codes must be consistent with the state's flood hazard mitigation requirements as articulated in the state building code.

At the state level, the floodplain management program is administered by the Division of Planning, CRMC, and the Freshwater Wetlands program within DEM (which considers floodplain impacts when reviewing applications for wetland alteration). For the most part, neither the towns nor the state agencies involved have been successful in using the floodplain management program as broadly as it could be in addressing the range of land use issues within its jurisdiction. Local floodplain management measures for the most part emphasize elevation and construction requirements, rather than avoidance of flood hazard areas per se. State authority has

not been used to enforce a strict interpretation of floodplain management principles, although hazard mitigation policy has been articulated.

Implementation: Local Programs

Interviews with planning officials at the local level suggest that the floodplain management program has not served to control development in hazard areas. In coastal high hazard areas, in fact, the availability of subsidized insurance has encouraged redevelopment in zones cleared of structures by the major storms of 1938 and 1954. Coastal area property values appear to be supported by the program, particularly given the nature of current policy on hazard area building modification and reconstruction. The divergence of the program from its objectives is due to weaknesses at local, state, and federal levels.

The Division of Planning is responsible for reviewing communities' compliance with floodplain management measures required of participants in the NFIP. Community assistance visits, which are conducted by the Division of Planning and FEMA are intended to assess the effectiveness of the local programs. In practice the Division has little or no information going into a site review and must rely on building inspectors to make files available. If a community program is found lacking, neither the state nor FEMA have adequate means to encourage improvement. FEMA may require that a \$25 fee increase be attached to policies in non-complying communities. Towns are given a year to improve procedures.

Enforcement of existing flood-related construction standards and stormwater management standards by local building inspectors was a major source of Task Force concern. Although CRMC has been involved in a joint effort with the Division of Planning and the State Building Commissioner's Office to improve the effectiveness of local enforcement, proposed legislation providing for training of local building inspectors, and for development of a rotating technical assistance program, has not yet been submitted.

In some communities, lack of availability of accurate, easily referenced floodplain data maps has complicated enforcement. FEMA provides Flood Insurance Rate Maps (FIRMs) for each participating community. Maps are periodically revised to reflect changed conditions, and FEMA is presently combining floodplain and floodway designations on new maps. These areas were previously mapped separately. In certain municipalities, however, base flood elevations for A Zones, which are important in a planning context, are not provided on the FIRMs. Current coastal flood hazard area maps, which serve as a critical tool in limiting high-hazard area development at the local and state levels, are presently being prepared as a product of FEMA's Hurricane Evacuation Program. These maps are as yet incomplete.

Concerns regarding inappropriate issuance of variances were reviewed by the task force. The state and local building codes require that any application for a variance from hazard mitigation requirements must be forwarded to the Division of Planning for review before the variance is granted. According to the NFIP, a variance is to be issued only under "exceptional circumstances." Permit applications require base flood elevation and other data necessary for evaluation of impact. If complete application data were provided, the data should provide a reference for flood evaluation at the local level, should allow the Division of

Planning to perform effective site reviews of local implementation, and should provide the Division of Planning with duplicate files of all variance applications, allowing for review of cumulative effects.

In fact, flood data provided on inland area permits is generally minimal, sufficient only to establish the permit fee. Only one town in the state (Barrington) consistently refers variance applications to the Division of Planning, so that the Division cannot participate in review and has only a limited notion of the degree to which variances are being issued in inland areas.

Implementation: CRMC

In coastal areas, the situation is somewhat different. CRMC has incorporated the federal construction and drainage requirements into the Red Book, and conditions applications to conform to federal requirements. In general, towns have completely transferred the administrative, technical, and political burden of NFIP implementation to CRMC in coastal areas. Although municipalities may not issue permits for development in flood hazard areas without CRMC approval, they may issue letters to applicants stating that a building permit will be issued, upon approval from CRMC. Partly because towns transfer responsibility in this manner, CRMC has not attempted to establish regulatory measures which move beyond the minimum federal requirements. (CRMC elevation requirements had exceeded those of the federal regulations until a wave height factor was incorporated into the federal regulations in 1980.)

The extent to which CRMC could use its authority over coastal hazard mitigation to supercede local floodplain management authority has not been tested. However, local communities which have attempted to take initiative in restricting high hazard area development through zoning controls, such as South Kingstown, look to CRMC for support and need stronger regulatory backing.

Construction and reconstruction in coastal flood hazard areas is a major source of controversy. The Hazard Mitigation Task Force recommended that developed barrier beaches which sustain extensive storm damage be designated as undeveloped, and therefore ineligible for certain federal construction and reconstruction subsidies. Similarly, the State Planning Council, adopted a position in mid-1987 calling for establishment of a procedure under the Coastal Barrier Resources Act to allow addition of presently developed barrier areas to the coastal barrier resources system at the time development conditions change.

CRMC prohibits construction on undeveloped dunes, prohibits reconstruction on dunes when a structure has been damaged by 50 percent or more, requires increased setbacks in these areas, and requires upgraded building standards. However, the precise definitions of threshold destruction and "substantial improvement" have never been fully clarified, for single structures or for whole barrier areas subject to potential redesignation.

The method used in calculating whether an addition, alteration, or reconstruction constitutes a "substantial improvement" is critical in determining the effectiveness of hazard

mitigation policy. The Rhode Island building Code and FEMA regulations differ as to how the value of a structure is defined. Rhode Island's accounting methodology is based on replacement value, while FEMA's is based on market value. Applicants have succeeded in applying an "in-kind" interpretation of "replacement value" which allowed accounting for replicating early building materials which now impose very significant costs.

In Rhode Island, value is further under-represented by virtue of the fact that under current state building code regulations, the cost of mechanical, electrical, and plumbing systems are excluded when calculating the cost of reconstruction.

Where less than 50 percent destruction has taken place, permits may not require that reconstruction meet NFIP standards, if the standards are "incompatible" with the original structural design. On dunes of four "developed" barriers, vertical construction is administratively permitted where alterations or additions amount to less than 50 percent of the structure's value. Council review is required where proposed construction would exceed the value of a structure more than 50 percent.

No specific state-wide authority exists to prohibit extension of public infrastructure into floodplains and coastal high hazard areas, although the need for such a policy has been repeatedly stressed, most recently by the Task force. While an Executive Order discouraging extension into hazard areas was reissued by the governor in 1987, it most significantly impacts the location of state buildings. The language called for "avoidance" of siting state facilities, or facilities funded in whole or in part by public monies, in a documented hazard zone.

A bill requiring all coastal communities in the state to develop plans guiding redevelopment after a severe hurricane was introduced by the Governor's Office in 1987, but was not enacted. The bill would have required that, in coastal communities, required revisions of comprehensive plans must include provisions for regulation of future development in hazard-prone areas as well as regulation of post-storm redevelopment in these areas. The bill also attempted to address the flood data accuracy issue by requiring communities to determine the areas within their jurisdiction most subject to hurricane damage. Although certain municipalities are addressing post-storm development issues (East Providence through its waterfront planning process and Charlestown through its comprehensive planning process), most have not been aggressive in this area.

The Salt Pond Area Hurricane Preparedness Plan proposed that CRMC adopt a set of emergency procedures to ensure that applicable building codes and other standards would be adhered to in the period immediately after a disaster, and to provide for imposition of short-term post-storm building moratoria in certain areas under specified conditions. These policies should be extended to all of the state's flood hazard areas.

Recommendations to the General Assembly

*****Amend the State Building Code to incorporate by reference the specific building regulations of CRMC, as updated to reflect the most recent technical guidance available regarding construction in coastal areas.**

*****Revise the Rhode Island Building Code to provide that the costs of mechanical, electrical, and plumbing systems be included when calculating the cost of a "substantial**

improvement" pursuant to the floodplain regulations. (This measure was introduced to the 1987 General Assembly, but was not acted upon.)

Recommendations to CRMC

****Amend coastal construction and reconstruction regulations to reflect the most recent technical guidance available regarding construction in coastal areas, (e.g. as contained in the most recent FEMA Coastal Construction Manual).**

****Revise the definition of "substantial improvement" as it applies to post-storm reconstruction to clarify decision criteria regarding 50 percent destruction, and to ensure that structures are re-built according to the most recent FEMA standards.**

*****Revise regulations to prohibit reconstruction of structures damaged more than 50 percent in *all* coastal V zones, in addition to dunes.**

****Develop a specific plan for the coordination of permitting review and approval procedures among all applicable agencies for use following a major storm event.**

*****To ensure the preservation of the remaining natural flood protection barriers and protective coastal features of the state for the general health, safety and welfare, prohibit development of infrastructure or reconstruction of damaged infrastructure in coastal flood hazard areas as stipulated by federal executive orders.**

****Require that information pertaining to the location of a property in a flood hazard area be included in the town Land Evidence Records as a permanent deed attachment and be recorded with references to all applicable zoning ordinances, subdivision regulations, building code specifications, and any other regulatory measures which pertain to its location.**

Recommendations to the Rhode Island Building Commission

*****Amend the State Building Code regulations to incorporate by reference the specific building regulations of CRMC, as updated to reflect the most recent technical guidance available regarding construction in coastal areas.**

*****Revise the Rhode Island Building Code regulations to provide that the costs of mechanical, electrical, and plumbing systems be included when calculating the cost of a "substantial improvement" pursuant to the floodplain regulations. (This measure was introduced to the 1987 General Assembly, but was not acted upon.)**

*****As recommended by the Hazard Mitigation Task Force, develop an assistance program, review program, or oversight mechanism to encourage improved implementation of existing and recommended floodplain management programs and local and state level requirements. The oversight should involve coordinating with the Division of Planning to track variances, exceptions, and other deviations from specified requirements.**

Recommendations to the Department of Business Regulation, Real Estate Division

****Require that sellers of property and/or real estate representatives inform prospective buyers as to zoning ordinances, subdivision regulations, building code specifications, and any other regulatory measures, which, because of the exposure of the property to a natural hazard, could influence decisions make by potential buyers**

3.3 THE ROLE OF LOCAL LEVEL INITIATIVES

Introduction

The Rhode Island 208 program gave clear emphasis to the role of land use in affecting water quality. In the executive summary, the plan stated:

Measures should be adopted which restrict land uses in sensitive areas. These "non-structural" controls would include land use planning (including open space and conservation planning and restrictive zoning. Considering available technology for abating stormwater pollution, *such measures may represent the only means of preventing water quality degradation in some areas* (italics added).

Use of zoning, subdivisions and health regulations, land acquisition, and extension of sewer service areas were all recommended as land use tools, in addition to development of a comprehensive land planning framework. Ten years after the 208 recommendations were put forward, it is appropriate to review the extent to which recommended management measures have been adopted, and to evaluate the issues surrounding exercise of local initiative. While the limited scope of this research effort cannot accommodate a comprehensive review of local programs and needs, a basic review of local initiatives, and a discussion of factors contributing to success or failure has been made. (See also the related chapter on the taking issue.)

GENERAL FINDINGS AND CONCERNS

(See also related chapters on source controls, particularly ISDS.)

Although constraints are imposed by the lack of comprehensive zoning enabling legislation in Rhode Island, **local governments have considerable authority over development, land use, and certain public health issues.** Zoning and land and water management controls are critically important in preventing groundwater pollution, protecting estuarine water quality, targeting growth toward resource areas capable of sustaining development, and preserving the unique amenity qualities of the Bay watershed system. **As a result, the management of land and water resources effecting the quality of Narragansett Bay depends heavily on the enactment and enforcement of local laws and regulations.** Several complicating factors, however, have served to restrict the effectiveness of local initiatives.

An issue of key importance is the inadequacy of planning capability in many Bay basin communities. Within the past five years, several small communities have moved to develop technical planning support, but town budget constraints frequently limit staffing capability. In several towns where recent growth rates have created a critical need for consideration of long term objectives, and a need for full-time professional assistance in evaluating and implementing alternative approaches, planning staffs are not available or are limited to one individual.

Communication among local officials within municipalities is frequently insufficient. Boards may be unaware of other town bodies' regulations, or may adopt contradictory policies. For example, a town engineering department may require developers to direct storm runoff into stream channels, or to the lowest available drainage point, while a planning board requires installation of detention/retention basins. Similarly, public works policies may be established to ensure that roads are interconnected to facilitate

movement of service and emergency vehicles and allow for efficient maintenance of infrastructure. In these communities, development of cul-de-sacs is discouraged or prohibited, and road or facility construction may be forced into areas where construction is in conflict with town aquifer protection or wastewater management policy.

Ordinances may also be severely diminished in effectiveness if specific regulatory language providing implementation responsibility is not incorporated into applicable board operating procedures and into the regulatory language of related authorities. For example, Middletown's comprehensive watershed protection ordinance provides for little or no development within 200 foot streambank buffer areas, or on poorly drained soils. Nevertheless, a subdivision permit was approved by the town planning board, which had not incorporated appropriate language into its operating regulations for subdivisions. On appeal to the board of review, the approval of the planning board was accepted as given, because the board had no contradictory authority.

In such situations, elected board members may have little power to ensure that town policies be internally consistent, particularly where a variance granted by one board may be appealed to a review body having conflicting or overlapping jurisdiction. Conservation Commissions are advisory only, have no coordinating responsibility, and have little role in the substance of permit review. Local inconsistency is perpetuated by the fact that permit applicants tend to prefer going through the hearing and appeals process at the state level rather than obtaining a variance from multiple municipal bodies.

In many towns, public works departments and municipal boards and commissions are insufficiently informed and/or unsympathetic regarding the objectives and regulatory requirements of state programs, which should be serving as a force to encourage local internal consistency, as well as consistency with state regulatory language. Planners, conservation commission members, District Conservationists, and state and federal scientists interviewed state that they must repeatedly stress to local boards that natural water resource systems have no regard for private or municipal boundary lines.

State regulatory tools which have been made available are often incompletely utilized. For example, attachment of permit conditions as deed encumbrances can be an extremely useful enforcement mechanism if supported at the local level. Section 2-1-22 (f) of the Amended Freshwater Wetlands regulations states that "notice of permit and notice of completion of work subject to permit shall be eligible for recordation under Chapter 13 of title 34 and shall be recorded at the expense of the applicant in the land evidence records of the city/town where the property subject to permit is located, and any subsequent transferee of such property shall be responsible for complying with the terms and conditions of the permit." This provision is very important, as outlined in previous sections.

In fact, the notices are inconsistently recorded. Although the Rhode Island Building Code references wetland permitting, no mechanism exists to ensure that building inspectors obtain the land evidence records and either verify recordation or assure compliance with stipulations before issuing building or occupancy permits. Because severe non-point pollutant impacts are associated with project construction, this program weakness is critical.

Generally, with regard to both state and local regulations, effectiveness is heavily dependent upon a local building inspector's interpretation of requirements, his/her commitment to ensuring that requirements are met, and the resources and time which are available to undertake inspections. Most local building inspectors have taken their positions based on familiarity with the building trade, and have limited qualifications where review of natural resource or environmental permitting factors are concerned. Further, many of these officials operate part-time or have other inspection responsibilities (such as plumbing or electrical inspection).

Building inspectors may also exercise considerable influence with regard to the scope and character of local initiatives. Although building inspectors are enforcement officials, and not policy makers, they nevertheless act in an advisory capacity to the zoning and planning boards, and may in some cases function as zoning officers. Boards may rely largely on a building inspector's opinion regarding constraints to implementation in determining an ordinance's appropriate scope, and in setting performance standards.

Partly because of the political pressures exerted on town councils to undertake resource protection initiatives with limited enforcement capability, many town ordinances describe the purpose of the law and the extent of its jurisdiction, but fail to outline clear performance standards. A great deal of discretionary authority thus passes to local officials.

The local special permit and variance granting processes are particularly vulnerable to the lack of standards and guidelines. Most town by-laws provide an appeal process through which many land use activities may be reviewed by boards of appeals or other designated authorities. Very often, the special permit granting authority or appeal board is an appointed board which does not formally adopt standards or policy guidelines for the issuance of permits. The lack of accepted standards not only inhibits accountability, but may allow for unjustified inconsistency in review procedure or for exercise of favoritism.

As discussed in further detail in related chapters, local provisions rarely go beyond the authority provided *in practice* by state regulatory language. In certain cases, local governments have attempted to regulate land use under police power authority, but with mixed results. Successful legal challenges of more aggressive local controls have served to exert a "chilling" effect on other local jurisdictions, particularly where findings of regulatory "takings" have occurred. Especially where environmental controls are concerned, municipalities see themselves as organs of the state whose primary function is to increase the potential efficiency of state initiatives.

Local governments actively concerned with resource protection look to CRMC, in particular, with its broad ecosystem protection mandate, to provide a strict regulatory interpretation which supports aggressive local action. Although the SAM plans have served as a basis for local regulatory change in certain areas, the plans have only been put in place in certain areas of the state. Further, CRMC views the SAM plans as primarily facilitating the use of local controls rather than as imposing increased state authority.

Communities with insufficient professional planning capability or without staff assistance for town boards have been the most reluctant to implement local controls which expand on a conservative interpretation of local authority. Given the lack of funds and personnel available in these small communities, the largely volunteer boards are strained in meeting basic review workloads and are unlikely to adopt additional requirements.

Fundamentally, the extent of variation among town initiatives is quite broad, with regard to approach and effectiveness. **In order to make a comprehensive determination of local government roles and potential responsibilities in Bay water quality management, an in-depth analysis must be completed, building on the efforts undertaken at the Division of Planning and by the DEM groundwater program.**

The analysis should involve a thorough inventory of water quality-related regulations at the local level, should describe funding and staffing levels, coordination mechanisms, and other factors contributing to the strength and weaknesses of local initiatives. In Massachusetts, such an inventory was completed over a one year period with Buzzards Bay Project funding, along with an assessment of Bay communities' progress in addressing the recommendations of the state 208 plan.

Overall Recommendations to Town Councils

Planning Capability and Review of Cumulative Impacts

Chapter 45-22 of the General Laws of Rhode Island required cities and towns to establish planning boards or commissions which are required to prepare comprehensive plans. The plans must include, among other requirements, environmental protection programs and a recommended program of action or implementation. In conformance with this statute:

*****Undertake an environmental review to support evaluation of community land use objectives, and development of necessary resource protection programs. Consider the range of important issues and factors outlined in guidance prepared by the Division of Planning to assist towns in preparing comprehensive plans as required by the 1988 Comprehensive Planning and Land Use Regulation Act. Develop an inventory and review strategy which will support broad planning objectives, including revision of the town Comprehensive Plan, revision of related town ordinances, adjustment of zoning policy, etc, as needed to ensure, at a minimum, consistency with state resource protection policy. The factors considered in the review should be assessed quantitatively, and estimates of error should be made where possible.**

****Prepare maps and overlays indicating locations of the factors investigated in the environmental review. These maps should reasonably draw upon (and be consistent with) available engineering master plans, facilities plans, zoning maps, flood designation maps, SCS soils maps, etc., but should clearly illustrate results of the inventories undertaken within the scope of the environmental review. The maps should be prepared at a scale sufficient to make them usable in public presentations, but should also be reducible for use as public education tools.**

*****Using the results of the environmental review, undertake an assessment of existing ordinances, by-laws, municipal policies, and other control**

mechanisms to determine whether allowable land uses, densities, and municipal practices are compatible with current knowledge of water quality protection needs.

*****Consider developing zoning or subdivision regulations which allow the Planning Board to request an Environmental and Economic Impact Statement (EIS) for subdivisions of 3 units or more. The EIS requirement would be designed to enable towns (in cooperation with applicable state agencies) to consider the cumulative impacts of development on town resources and service needs.**

Results of the cumulative impact analysis would be compared with local, state and federal performance standards, and should include, at a minimum, provisions for determination of nutrient loading and consideration of runoff and sedimentation impacts. Falmouth, Massachusetts has applied a subdivision ordinance and analytical methodology which include use of a nutrient loading model that account for inputs from human waste, lawn care, and road runoff. (See Special Problems: Activities in other States)

The requirements for cumulative impact analysis attached to the recommended ordinance should specify:

- an identification of developments requiring submission of an EIS (e.g. if a portion or all of the proposed development lies within the watershed or zone of contribution of a freshwater or coastal pond or embayment or a public water supply well (existing or proposed)).
- criteria for determination of cumulative impact (including, for example, determination of the nutrient loading of the proposed subdivision and a comparison to the carrying capacity of the receiving waters, and setting forth the probable impact or effect of the proposed subdivision on the receiving waters (ground or surface) over a period of time, assuming completion of the maximum level of development proposed).
- methodology for analysis of contaminant loading to the groundwater or to other receiving waters impacting the town's or region's critical resources (including sole-source aquifers, coastal and inland ponds, and embayments).
- state or federal performance standards which must be applied in preparing an analysis of the existing condition of the water body or supply, and the expected change in the condition of the water body or supply as a result of the proposed development.
- methodology to be applied in comparing, on a per acre basis, the contaminant loading from the proposed development with: a) the existing and potential loading from all other developments and acreage within the recharge area of the water supply or water body; and b) the loading rate which would be expected to produce critical eutrophic levels or exceed applicable water quality standards in a water body.

- measures to reduce nutrient loading if per-acre loading rates from the proposed development will equal or exceed the critical loading rate when combined with existing and potential development within the water's recharge area.

Other potential environmental impacts which should be addressed by the cumulative impact analysis include economic effects which should be analyzed as components of the EIS including:

- availability of town water, and the effect of the development on town-wide capacity and provision of services, including future water supply
- estimated taxable value of the development proposed
- expected impact on schools classroom space, bus transportation and cost to the town of impacts on the school system
- impact on traffic patterns and congestion
- estimated additional service requirements to be placed on the town, including solid waste disposal and snow removal
- estimated additional burden on public safety services

****Using the results of the recommended Environmental Review, results of loadings data from state and federal performance standards, nutrient and contaminant loading data assimilated from EIS results, and other available data on the condition of resources, establish a procedure by which zoning standards can be revised to consider cumulative impacts of development on natural resources which support public welfare.**

*****Adjust zoning density to specifically consider cumulative impacts of development-related resource contamination, to reflect siting limitations identified in the environmental review or in other research on the carrying capacity of the resource base, and to be consistent with public health protection objectives.**

*****Adopt formal standards and policy guidelines clearly defining permit review procedures, appeal review procedures, and procedures for granting variances, variations, and special exceptions. Include these standards, and procedures for public notification, in applicable municipal code. Ensure conformance with the Rhode Island open meetings law.**

****In coordination with DEM, CRMC and land preservation groups, develop a clear methodology by which to inventory sensitive lands having priority for public acquisition. (An Acquisitioning Inventory of this nature, setting priorities for action, has been developed by the Narragansett Land Conservancy Trust.)**

Staffing

*****Consider creating a new town officer position to assist town boards in coordinating health-related, land use, and environmental concerns. The**

Environmental Protection Officer could be designated an ex-officio member of the planning board or the town council, and would serve as an agent of the town with the flexibility and authority to initiate regulatory and legal action. The Environmental Protection Officer would assist the building inspector and the staff of the building department in ensuring compliance with state and local resource protection requirements.

The Environmental Protection Officer, and the Officer's staff assistants would be licensed professionals who had successfully completed training in biology, ecology, environmental science, environmental engineering, forestry, or a related field.

The officer would serve as a liaison between town and regional bodies having jurisdiction over land use and water quality related concerns, including the town council, the planning and zoning boards, the conservation commission, the wastewater management district, the department of public works, and the soil and water conservation district. The officer would attend board meetings, work with related state agencies, assist applicable boards in reviewing resource inventory assessments and permit applications, and foster communication among these groups.

Copies of all state environmental permit applications would be submitted to the Environmental Protection Officer. The officer would familiarize himself/herself with state permitting requirements, and would be required to attend periodic workshops held by the state permitting agencies to update environmental protection officers and local building inspectors regarding adjustments to state requirements. Upon payment of a review fee to cover administrative and research costs, permit applicants would be able to obtain from the officer a preliminary review of the adequacy of the application, and potential adjustments necessary in order to comply with state requirements.

Dedicated permit fees, land transfer assessments, fines collected as a result of enforcement actions, etc. could be used to fund these positions.

*****Ensure that building inspectors have sufficient staff assistance to enable them to meet their responsibilities in monitoring compliance with local and state programs related to water quality and resource protection. Staffing capability must be sufficient to ensure that a full review procedure can be completed, including:**

- a) preliminary site visit to appraise owner/developer of the state and local permits which will be required, including as applicable:
 - freshwater wetlands
 - coastal
 - ISDS
 - other state discharge permits
 - town zoning approval
 - town subdivision approval
 - floodplain development (copies of variance requests forwarded to the Division of Planning, CRMC and Freshwater Wetlands Section)
 - town erosion and sediment control plan
 - town stormwater management plan
 - town building permit
- b) review of permit application recordance in the land evidence records

- c) review of conditions and requirements stipulated in completed permit recorded in the land evidence office
- d) communication with the planning and zoning board to determine whether subdivision and/or zoning approval has been granted and the conditions attached.
- e) inspection of stormwater and erosion and sedimentation control facilities and other resource protection controls *before* groundbreaking begins
- f) coordination with applicable authorities to schedule timely inspection of ISDS and stormwater and erosion and sedimentation control facilities at key points *during* construction and following *completion* of construction (see related chapters on these issues). Referral of any violations to appropriate town and state enforcement authorities.
- g) construction-related site inspection (preliminary; footing; backfill; framing; and final)
- h) inspection to ensure compliance with any corrective measures required during construction, and with applicable permit conditions
- i) issuance of occupancy permit

*****Ensure that the staff resources dedicated to inspection and enforcement (including staff of the building inspector, or the combined staff of the building inspector and the environmental officer) *grow proportionally with the development activity in the town*.** This is particularly true at the present time in Rhode Island, as development pressure is increasingly forcing activity into marginal lands. The pressure on marginal land is expected to increase dramatically within the next ten years. Dedicated permit fees, land transfer assessments, fines collected as a result of enforcement actions, etc. could be used to fund additional staff positions.

SPECIFIC FINDINGS AND CONCERNS REGARDING EXERCISE OF LOCAL INITIATIVE

(See also related chapters on source controls, particularly ISDS, and Appendix 3.1.)

ZONING

Findings and Concerns

Under the Rhode Island State Zoning Enabling Act (RIGL 45-24) towns have authority to establish land use provisions and to set use restrictions by district. In addition to the three general zoning types in place in most towns (including residential, commercial, and industrial), certain Bay basin towns have enacted protective by-laws specifying conditions for residential development and setting a permit and appeals process for other forms of development. Lot size, shape and dimensions, allowable density of structures, frontage requirements, parking and height stipulations and allowable use are all established via zoning regulations. Municipal zoning and permit conditioning can prove extremely important in control of non-point pollution.

Types of residential districts vary broadly. Rural residential districts may allow only large-lot single family homes, while mixed-use districts permit multi-family housing and business use in addition to single-family structures. In commercial districts, a wider variety of business and residential uses may be combined in an area. On the other hand, in industrial districts, manufacturing and warehousing may be provided for while residential use is prohibited. Unrestricted or general districts set no restriction on use.

Recently, towns have established special purpose districts to allow more precise definition of development goals, and to control development patterns in such a way as to protect public health and welfare. Special purpose districts may be used to protect traditional land uses, preserve amenities, maintain community character, and to meet other community needs. Such districts include village commercial, agricultural, open space, marine/waterfront, aquifer protection, drainage control, and flood hazard management districts. Rural residential and agricultural districts frequently allow single low-density dwellings, farms, and home occupations, while open space districts are generally reserved for public use. Village or neighborhood districts are established in an effort to permit a concentrated mixture of residential and small business use, thereby encouraging the development of definable village centers, while discouraging costly exurban sprawl.

Other recent zoning initiatives which can enable towns to address non-point source issues include use of zoning by-laws to allow clustering or planned unit development (in which reduced lot sizes are allowed in exchange for open space set-asides) and establishment of marine, waterfront, or harbor districts, providing for exclusive water-dependent use.

Given the fact that zoning regulations enable municipalities to consider land use suitability and compatibility of use, districting may be used to preserve certain uses or aspects of community character (e.g. historical areas, fishing villages), to reserve areas for a potential use (such as water supply), or to prevent irreversible trends which eliminate further public consideration (waterfront development). Temporary building moratoria may be imposed while consideration is given to the long term objectives of zoning policy and proper implementation methods.

Zoning ordinances and by-laws can address non-point source issues by defining allowed land usage, setting minimum lot sizes, and by specifying allowable percentage of lot coverage. In terms of non-point source impacts, development density is related to aquifer recharge potential, flooding hazard, stormwater runoff contamination, lawn-care related pollutant loading, and rate of ISDS effluent discharge to receiving waters. Minimum lot sizes in the Rhode Island portion of the Bay basin range from 3000 sq. ft. for a single family dwelling in Newport to 5 acres for farming-residential districts in Burrillville, Exeter, and West Greenwich. Selected large lot and open space zoning controls in place in Rhode Island are listed in Table 3.1. The Table also shows smallest currently permitted lot sizes.

Because roughly two thirds of Rhode Island communities depend upon groundwater to a significant degree as a source of potable water supply, groundwater resource protection has increasingly been recognized as an important local government function. The state's principal groundwater aquifers

Table 3.3

Large Lot Size Zoning Requirements Among Rhode Island Communities
 (note: lot dimensions given establish minimum requirements)

Lot Size Zoning Requirements Establishing a Minimum Five Acres per Dwelling Unit

Burrillville - Farming District (single family residences permitted) - 5 acres (1982)

Charlestown - Residence Farming District - 5 acres (1984)

Exeter - Conservation-Recreation District (single family residences permitted) - 5 acres

Foster - Agricultural-Residential District - 200,000 sq. ft.
 Neighborhood Commercial District - 200,000 sq. ft. minimum for family residences (1981)

Jamestown - Rural Residential District - 200,000 sq. ft.
 Open Space District - 200,000 sq. ft. (single family residences permitted (1983))

South Kingstown - Rural Low Density - 200,000 sq. ft.

West Greenwich - Rural-Farming-Residential - 5 acres (1983)

Minimum Residential Lot Size Zoning Requirements Exceeding 80,000 Square Feet

Gloucester - Agricultural-Residential - 4 acres
 Agricultural-Residential - 3 acres
 Residential - 2 acres (1984)

Newport - Rural Residential - 160,000 sq. feet
 Rural Residential - 120,000 sq. feet (1984)

North Smithfield - Rural Estate Agricultural Zone - 120,000 sq. ft. (1982)

Scituate - Rural Residential - 120,000 sq. feet
 Single Family Residential - 120,000 sq. feet (1982)

Open Space: No Residential Use

Burrillville - Conservation and Open Space District - 5 acres

East Providence - Open Space District - 100,000 sq. ft.

Middletown - Open Space District - 100,000 sq. ft.

Pawtucket - Public Open Space District - 100,000 sq. ft.

are located in relatively shallow sand and gravel deposits, and are thus particularly vulnerable to contamination from non-point and other sources .

Several local governments have enacted zoning ordinances specifically addressing groundwater protection. This zoning formula involves the designation of areas of particular concern with regard to groundwater contamination. The mapped area is superimposed over the existing town zoning map, and land use restrictions imposed by the overlay district have precedent over the underlying primary zoning restrictions. In early 1986 DEM's Groundwater Section surveyed all 39 cities and towns in the state to learn what applicable ordinances were in effect. The following summary of available regulatory and non-regulatory tools in place draws from the results of that survey and from interviews with state and local officials and planning staff.

Zoning Overlay Districts

Exeter, Middletown, Narragansett, North Kingstown, North Smithfield, and Richmond amended their applicable zoning ordinances to include groundwater protection overlay districts:

Exeter Zoning Ordinance, Article II Section 8, Groundwater Overlay District, adopted February, 1985.

Exeter designates its groundwater overlay district to include:

..."all land in the Town designated as "Outwash" on the Ground Water Maps of the USGS or land overlying groundwater reservoirs or groundwater recharge areas as identified on a map entitled 'State of Rhode Island '208' Areawide Water Quality Management Plan - Water Related Sensitive Areas,' and also that such land has been designated by the Town Council as an existing or planned public drinking water source, shown as Groundwater Recharge Areas on overlays of Assessor's Tax Maps." In cases of disputed boundaries, the burden of proof is placed on the property owner to show where the boundary should be located.

Exeter allows uses in the overlay zoning district which 'do not allow contaminants in significant amounts' to enter the groundwater. Property owners are required to submit proof of non-contamination to the Zoning Board in order to receive a development permit, although the method of proof required is unspecified. A list of fourteen prohibited uses includes: disposal of solid wastes, storage of petroleum products (heating uses exempt), industrial wastewater discharges, storage or disposal of hazardous waste, rendering impervious more than 10 percent of any lot, open storage of road deicing chemicals, automotive service shops and salvage yards.

Middletown Zoning Ordinance, Article 9 Watershed Protection District, adopted December, 1985. (note: includes *surface water* protection)

Middletown's two-tier watershed protection ordinance has a stated purpose to "protect, preserve, and maintain the quality and supply of groundwater and surface water" upon which the town depends. The ordinance defines a 'Zone I' which is "critical to the protection of surface and sub-surface water supplies, and requires a high degree of protection from incompatible land uses." Catchment areas and runoff are within the jurisdiction of 'Zone 2' which "is the watershed area which is contributory to surface water

runoff to the primary water bodies contained in Zone 1, and which drains into Zone 1 areas through surface water runoff or groundwater movement."

All land within 200 feet of surface waters and those areas of certain wet soils (Stissing and Mansfield Silt Loams) are included in Zone 1, while Zone 2 includes all other areas of the watershed as officially zoned. Permitted land uses in Zone 1 are open space uses, residential, and uses accessory to residential. Uses prohibited in Zone 2 include: junkyards, sewage treatment plants, incinerators, landfills, transfer stations, car washes, manufacturing uses which do not discharge wastewater to a public sewer system, road salt storage, storage and disposal of hazardous waste, storage of fuel in excess of 300 gallons (above or below ground), except those uses subject to the Underground Storage Program regulations. Applicants seeking special exceptions to requirements in either zone must submit supporting documentation including lists of chemicals to be used, geohydrologic analysis, and a water quality sampling plan.

North Kingstown Zoning Ordinance, Article VIII, Overlay Districts, adopted April, 1974.

North Kingstown bases its overlay designation on hydrogeological parameters, including all lands defined by USGS as overlying deposits having a saturated thickness of over 40 feet and a transmissivity exceeding 60,000 gpd. In Groundwater Reservoir Overlay Districts, permitted uses are limited to single family residential, recreation, conservation, and agriculture. A minimum lot size of three acres is applied, with maximum impermeable lot coverage of 20 percent. Recharge Overlay Districts are regulated in a separate section of the zoning ordinance, which provides that discharges into groundwater must meet applicable EPA standards. Other uses are allowed by special exception, provided an applicant successfully proves that the proposed use will have no polluting effects (method not described).

Recommendations to Town Councils

Overlay Districts

Develop programs to ensure consistency between land use and water resource/supply protection objectives:

****Using results of the environmental inventory and review recommended in related sections, prepare maps of important water resources, including areas influencing municipal wells, primary recharge areas to existing or potential future municipal wells, high yield aquifer areas, wetlands, and other areas subject to storm flowage and important as flood storage areas.**

*****Use overlay zoning to protect these areas, via formulation of aquifer protection overlays, flood hazard overlays, water resource protection districts, etc. Within the designated districts, restrict density and prohibit uses which could potentially impair the viability of water resources per se or integrated hydrologic systems.**

****Consider forming watershed-wide water resource protection advisory committees to advise planning boards of the member towns on development within the watershed. Development proposals would be reviewed by the committee, and findings and recommendations would be reported to the municipal body or bodies having jurisdiction.**

Shorefront Districts

*****Revise zoning ordinances to state specifically that, in shoreline areas, preferred consideration will be strictly given to those forms of commercial activity which clearly are water dependent and which are primarily oriented to the coastal region. State clearly the forms of commercial activity preferred, including port terminals and wharves, commercial fishing, fish processing and distribution, protection of scenic vistas and access for the public, oceanographic research, marinas and boatyards, etc. Specifically stated preferences for water-dependent uses would not only provide improved predictability to applicants and discourage submittal of inappropriate applications, but would give support to municipalities in developing harbor management plans and establishing marine or waterfront zoning districts.**

The set-asides required should be based on such factors as degree of water-dependence, loss of unrestricted public physical access, loss of visual access, percentage of area covered by impervious material, scenic considerations, impact on traffic and congestion, and other factors. Establish height and lot area coverage limits to promote visual access to the shoreline.

SUBDIVISION REGULATIONS

Findings and Concerns

Under the authority of the Rhode Island Subdivision Control Law, planning boards are required to adopt ordinances pertaining to land on which new roads are being built to obtain access to one or more lots lacking adequate frontage. Generally such ordinances and regulations provide standards for the construction of roadways, utilities, curbs, sidewalks, and other aspects of road, street, and building layout, including drainage and construction specifications. In other states, subdivision ordinances also frequently have jurisdiction over commercial developments and industrial developments as well as residential areas.

By establishing drainage stipulations, subdivision regulations govern local quantities and patterns of surface and sub-surface flow, and can require flood control and hazard mitigation measures. Thus, water quality impacts of runoff and erosion can be significantly affected by the emphasis of these regulatory instruments. Unfortunately, subdivision regulations frequently exacerbate runoff problems by requiring features such as wide streets, curbs, piped drainage, double sidewalks, and paved driveways, all of which retard groundwater infiltration. In addition, most regulations require that runoff be collected in storm drains and directed to the nearest surface water channel, a practice which limits recharge, exacerbates downstream flooding potential, contributes to watershed hydrological modification, and speeds the transport of runoff-borne pollutants to receiving waters.

To address non-point pollution concerns, subdivision regulations controlling drainage design may require installation of detention basins, grease and oil traps, gravel driveways and road shoulders, roof drainage dissipators, etc. Regulations may also require terracing of slopes, retention of natural vegetation, reduction of road dimensions, and other means of retarding runoff. A recent amendment to the enabling act governing local subdivision ordinances specifically includes securing "adequate drainage and provision of erosion

controls to mitigate stormwater runoff" among the purposes of subdivision rules and regulations.

Several towns have used subdivision regulations to establish control over drainage and stormwater runoff, to address both flooding and water quality concerns. In Narragansett, for example, new regulations specifically require that drainage plans be provided for all new subdivisions and commercial developments. East Providence subdivision regulations provide the city engineer authority to require installation of retention basins in flood hazard areas where runoff must be limited. Charlestown, in an effort to address concerns regarding flood hazard as well as contamination of salt ponds, requires that all subdivisions and both commercial and industrial developments plan for stormwater runoff. Calculations must be based on the 2, 10, and 100 year frequency storm.

Recommendations to Town Councils

The Stormwater and Erosion Control Committee prepared a set of general recommendations to towns, encouraging incorporation of stormwater management objectives and appropriate site design into subdivision regulations. In addition, the committee's technical recommendations on stormwater management and erosion and sedimentation control should be incorporated in detail into town ordinances to the maximum extent possible. Provisions which may be incorporated into subdivision regulations, or adopted as planning board standards include:

1. Control stormwater on site to prevent degradation of surface waters, depletion of groundwaters, and exacerbation of flooding problems;
2. Use detention basins to collect runoff from catch basins and drains; transport piped stormwater to detention basins rather than to surface waters;
3. Use perforated pipes to recharge underlying aquifers. Use grassed swales and rip-rapped channels as alternatives to subsurface stormwater drainage networks;
4. Use dry wells or infiltration devices where appropriate to collect roof drainage;
5. Collect parking lot runoff in catch basins (equipped with oil and grease traps) which subsequently drain into detention basins. Schedule regular maintenance of traps and detention areas;
6. Place limitations on the impervious surface area of roads, driveways, and sidewalks, consistent with minimum federal requirements to reduce surface area contributing to runoff. Discourage use of curbs and berms except as specified in the committee guidelines. Encourage use of gravel driveways, road shoulders, and walkways;
7. Limit site impervious area to 10 percent. Encourage use of gravel or porous pavement to meet impervious area limit;
8. Require that post-development peak runoff equal pre-development quantities; and

9. Require maintenance of natural buffer strips adjacent to surface waters in critical areas. If vegetative filter strips must be used as an alternative to natural cover, require use of recommended seed mixtures necessitating little or no fertilization.

EROSION AND SEDIMENT CONTROL/EARTH REMOVAL

Findings and Concerns

In many states, earth removal is regulated under home rule zoning powers, for the purpose of conserving natural resources and ensuring appropriate use of land. Because earth removal operations may impair the natural filtering capacity of vegetation and soils, ground and surface water quality may be significantly impacted. Allowable depth to water table, maximum slope, revegetation, and other erosion control requirements are generally included as stipulations. Although construction activities and agriculture may be exempted from a range of the provision, earth removal regulations may also address nuisances such as dust, noise, traffic, and erosion inducing activities.

Chapter 46 of the Rhode Island General Laws provides enabling authority to towns to enact soil erosion and sediment control ordinances, and may be interpreted to address earth removal. The statute provides a model ordinance whose provisions must be included in a town-adopted ordinance. Other provisions and definitions "such as are not inconsistent with" the act may also be enacted by towns. The statute references the Freshwater Wetlands Act, requiring that site plans for erosion and sediment control incorporate the wetland permit conditions. The statute also requires that building permit fees be based on the combined cost of the building itself and the sediment control facilities, sets bonding policy, and establishes maintenance responsibility.

Although several towns have enacted ordinances under the enabling act, implementation has been inconsistent, due to the statute's vague performance standards, lack of funding and inspection personnel at the local level, weak local support, and lack of provision for state oversight authority.

Recommendations to Town Councils

*****Revise procedures of the municipal highway department, the department of public works, the sanitation department, and other applicable service and maintenance departments to ensure that procedures and practices of these departments are consistent with the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding erosion and sedimentation control, design and installation of best management practices, and maintenance and repair of facilities.**

*****Under the existing sediment and erosion control enabling authority, or within the provisions of an expanded state stormwater runoff and sediment control law, develop town ordinances and by-laws which, at a minimum, incorporate the provisions of the Stormwater Management and Erosion Control Committee.**

*****Revise town regulations to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding erosion and sedimentation control, design and installation of best management practices, and maintenance and repair of facilities. These technical requirements will be defined in the updated Rhode Island Sediment and Erosion Control Handbook, currently in press. Attach applicable erosion and sedimentation controls and maintenance and repair provisions to all local building permits.**

To regulate earth removal in a manner complementary to erosion and sediment control provisions:

- set a maximum depth from the seasonal high water table for earth removal;
- require that erosion control measures as recommended by the Stormwater Management and Erosion Control Committee be put in place and maintained during the full course of earth removal operations; and
- set maximum grade, loaming (topsoil replacement) and planting and seeding requirements as recommended by the Stormwater Management and Erosion Control Committee for excavation operations and maintenance of sites following earth removal.

STORMWATER MANAGEMENT

Findings and Concerns

Although specific stormwater management enabling authority has not yet been provided to towns, several municipalities, including Smithfield, Scituate, and Cranston have addressed stormwater in their erosion and sediment control ordinances. In addition, Special Area Management Plans minimize allowable construction within floodplain areas, and require consideration of stormwater management as it relates to flooding. Certain towns are addressing stormwater via other authorities. East Providence, for example, reviews developments with regard to downstream runoff and requires installation of retention devices in critical floodplain areas. Narragansett and Charlestown review runoff within the authority of zoning and subdivision controls. South Kingstown is considering enacting a specific stormwater management by-law.

Stormwater runoff from town secondary roads and neighborhoods has been shown to be a very significant source of contaminant loading, particularly in areas having large domestic dog populations (See Heufelder (1988) in related chapter on stormwater management and erosion and sediment control.) In the Narrow River watershed, runoff management was viewed as an important objective in formulation of the SAM plan.

Recommendations

*****Revise procedures of the municipal highway department, the department of public works, the sanitation department, and other applicable service and maintenance departments to ensure that procedures and practices of these departments are consistent with the technical requirements, recommendations and language of the Stormwater and Erosion Control**

Committee regarding erosion and sedimentation control, design and installation of best management practices, and maintenance and repair of facilities.

*****Revise town regulations to specifically incorporate the technical requirements, recommendations and language of the Stormwater and Erosion Control Committee regarding stormwater management planning, design and installation of best management practices, and maintenance and repair of facilities. Attach applicable stormwater controls and maintenance and repair provisions to all town building permits.**

*****Institute regular street sweeping programs to control build-up of contaminants on road surfaces.**

****Where waste clean-up ordinances cannot be put into effect enact ordinances requiring that dogs not be "curbed" (as is frequently required in older regulations), but rather walked in turfed areas where runoff can be minimized.**

APPENDIX 3.1: ISSUES SURROUNDING EXERCISE OF REGULATORY CONTROL

Introduction

In spite of the constraints imposed by the lack of comprehensive zoning enabling legislation in Rhode Island, local zoning and land and water management controls are critically important in preventing groundwater pollution, protecting estuarine water quality, targeting growth toward resource areas capable of sustaining development, and preserving the unique amenity qualities of the Bay watershed system.

Numerous interviews conducted during the course of this research effort indicate that there may be widespread misunderstanding, particularly at the local level, regarding the legitimate exercise of government authority as that authority potentially affects land use.

Rhode Islanders recently amended the State Constitution to require that the state's "takings" clause be construed in a manner as favorable to the environment and to the police powers of government as the U.S. Constitution permits. Nevertheless, a prevailing atmosphere of extreme regulatory caution has manifested itself in reluctance to embark on local regulatory efforts, in disinclination to deny or properly condition development permits, and in delay of action on key legislative initiatives affecting local authority. Apparently, the myth that the "takings" clause allows landowners to do as they please with their land or be compensated remains "more powerful than the clause itself" (Bosselman et al., 1973).

Because much of the concern may be based upon concerns regarding recent judicial decisions, it is important to clarify some of the key issues. The following sections outline the factors which constrain and foster application of strong local controls, and suggest ways in which local initiative is affected, both positively and negatively, by the larger planning, regulatory, and judicial environment. Further, methods and strategies are suggested by which governments can structure strong policy instruments so as to avoid allegations of regulatory infringement, and can refute such charges if brought.

Fundamentally, positive actions need to be undertaken by state regulatory and planning bodies to foster and support strong local water quality protection initiatives, given existing concern regarding these issues.

Powers Available to Local Communities

Powers generally vested in a community which may be important in implementing non-point source controls include:

- Regulatory powers; widely used, consisting primarily of zoning, subdivision regulations, building code provisions, and disclosure laws.
- Taxing powers; providing for the use of strategies involving tax incentives and disincentives and special resource area assessments
- Spending powers; enabling towns to undertake expenditures for resource evaluation, water supply protection, hazard mitigation, structural and non-structural

controls, maintenance, land acquisition, and regulatory enforcement. Because a community's provision of infrastructure (such as sewer extensions) may create new non-point problems associated with development while addressing other non-point control needs (such as ISDS-related groundwater contamination), the power not to spend may also provide significant leverage in approaching non-point source issues.

- Acquisition powers; providing communities with the authority to purchase or condemn complete parcels of land, to arrange for easements or limited rights on land, and to guarantee necessary access where public health and welfare issues may dictate

Constraints on Exercise of Community Powers

The scope of community powers are primarily constrained by constitutional doctrines, by the sources of those doctrines, and by judicial interpretations of each. Key limitations and problems should be considered in evaluating constraints to local powers.

Constitutional Limitations

1. Due Process

"... nor shall any state deprive any person of life, liberty, or property without due process of law."

The constitutional guarantee of due process requires that a community rationally and not unreasonably exercise its powers, as reflected by the end results sought by the community and by the means which it uses to achieve its ends. Due process requires a government action to be within the limits of that body's powers and for proper objectives. To satisfy due process, there must be a valid connection between the regulatory action and accomplishment of the stated objective. Restrictions imposed must not be arbitrary.

Since a community can use only those powers which are legally vested in it, the breadth and source of power available must be defined. Courts establish clarification of the source of local power in order to determine a power's proper objectives. In Rhode Island, where home-rule is fairly weak, localities are creatures of state and have only the powers that are granted to them by the General Assembly. Nevertheless, existing statutes provide sufficient authority for municipal adoption of zoning, subdivision, and building codes, and other regulatory strategies for protection of flood hazard areas and community water supplies. Where specific enabling legislation is passed which augments home rule power, additional support is provided for the adoption of local regulations having broader objectives.

Having determined the source of power, it is necessary to establish validity of purpose. Acquisition, spending, and taxing powers, if granted, may be broadly used to approach non-point source control objectives. More significant limitations may be placed on regulatory objectives, which must be grounded in the community's police power, that is, the community's power to promote and protect the public health, safety, and general

welfare. "General welfare" encompasses the protection of the social, economic, physical, and political well-being of the community.¹

All non-point source control regulations must have police power objectives, generally defined to include:

1. Minimizing dangers to public safety by controlling land uses which harm others;
2. Preventing fraud and providing citizens with the ability to make informed choices when purchasing property; and
3. Reducing community expenditures, and in particular, protecting the public purse from future demands for relief.

To illustrate, a community may use overlay zoning to restrict subdivision development within an area of high water table soils where multiple ISDS failures have occurred. Such a mechanism promotes the legitimate end of controlling development (which may harm others due to resultant ISDS overflows or aquifer contamination). Such a measure may also reduce expenditures, in that continued development of such an area beyond its capacity to assimilate waste would create a public health hazard likely necessitating extension of town sewer facilities. Similarly, regulations may require the disclosure of information on deeds that, for example, an ISDS is sub-standard, or that a property is located within a floodplain and thus subject to high water table or flood inundation. Such disclosure provisions enable a potential buyer to evaluate whether he or she is willing to assume the risks which purchase entails.

Potential public health risk gives broad scope to a community's police power. Since many non-point source pollutants can represent significant health risks, controls imposed can generally be demonstrated to meet the means tests of due process: that the means are rationally related to accomplishment of the regulatory objective, and are not arbitrary.

The interpretation of the term "arbitrary" is of key importance. In the context of due process, local governments base their actions on a generally accepted level of evidence in order to ensure that they are comporting with due process. However, due process does not require unequivocal site-specific scientific evidence, and should not; much emerging scientific data of key importance in assessing risk remains subject to uncertainty. Due process does require that a "rational basis" be established between available information and the policy choices made by elected officials (Godschalk et al., 1977).

Actions of a government related to exercise of police power are generally given a strong presumption of validity and constitutionality.² As articulated in Parker, for example:

"...the settled rule seems to be that the court will not substitute its judgement for that of the...body charged with the primary duty and responsibility of determining whether its action is in the interest of the public health, safety, morals, or general welfare."³

¹Day-Bright Lighting, Inc. v. Missouri, 342 U.S. 421 (1952)

²Village of Euclid v. Ambler Realty Co., 272 U.S. 365 (1926)

³In re Appeal of Parker, 197 S.E. 706,709 (N.C. 1938)

Because judicial rules place the burden of proof on an opponent of a government action to prove it invalid, courts may play a narrow role in examining a locality's determination. Courts have also agreed with data experts that imperfections are inherent in land and water resource data collection and mapping, and that approximations must be used in providing timely clarification of management objectives.

The degree of support needed to buttress an action may as a practical matter be related to how the scientific evidence is to be used. The more severe a regulatory action, the more confidence should be attached to the data required to support the initiative. Particularly with data related to protection of public health, however, the presumption of validity coupled with the heavy burden of proving a regulatory action arbitrary may allow a community broad discretion in taking regulatory initiative.

2. The Taking of Property

"...nor shall private property be taken for public use, without just compensation"

Non-point source controls generally limit development options available on properties affecting certain resources, and prescribe construction and maintenance practices which must apply so as to control adverse affects of specific property uses. As such, communities imposing such controls may be open to legal challenges in which property owners attempt to establish that regulations have "taken" or unconstitutionally burdened a given property without paying compensation. If a court finds that a "taking" or "inverse condemnation" has occurred, it may invalidate the regulations as to the particular piece of property involved in the suit, or may require that compensation be paid to the owner by the responsible regulatory body.

Approaches to Evaluation

In examining allegations of taking, courts generally take one of two approaches, and resolve on a case-by-case basis, such that the facts of each case largely determine the law. In the first approach, a determination is made as to whether the activity regulated is a nuisance use or harmful to the public health or safety. The second approach focuses on property value, balancing the effect of the regulation on the value of the complainant's land against the public value or purpose of the regulation. Courts have applied both the nuisance test and the reasonable use or diminution of value test, or variations thereof, within the same case.

In the nuisance approach, regulations or actions prohibiting use of land which substantially threaten public health or safety or impair enjoyment and use of nearby resources are generally not found to effect a "taking." In the Del Norte case in California,¹ for example, the flooding that had consistently been so damaging in the area at hand made the proposed subdivision use of that land a nuisance.

Even where recent damages have not occurred, regulations can still be regarded as controlling a nuisance. Proof that unregulated actions in an area would increase public exposure to chemical, disease, or flood hazard, impair correction or relief efforts, or

¹Turner v. County of Del Norte, 101 Cal.Rptr. 93 (1972)

endanger the public health through the water supply, for example, will show that a potential nuisance is being responsibly regulated.

The control of nuisance places a community's use of police power in its strongest position with respect to takings and due process. Regulations directly protecting health and safety have long resisted takings accusations, receiving broad judicial support.

In evaluating reasonable use and diminution of value, courts operate from the premise that all economic use of an owner's land cannot be precluded by government action. The balancing test used in reasonable use assessments involves weighing the impact of the regulatory action on the individual or on the potential overall use of the property, as against the importance of the community interest. "Community interest" considerations include the likelihood of the harm the government is seeking to prevent, the immediacy of its threat, and the potential severity and scope of the harm.

Establishing a Taking

Many takings cases turn on the complex issues involved in establishing reasonable expectations for property us so as to establish the point where potential economic use ends and a taking begins. This issue has been complicated by recent cases, which have considered land as a collection of "parcels," involving separate ownership expectation. Some early floodplain management cases, however, illustrate longstanding themes. In the Dooley case, testimony showed that the land use restrictions imposed had depreciated the value of the complainant's land by at least 75 percent, and the court concluded that the burden imposed on the property owner was unfair.

The case of Turnpike Realty v. Town of Dedham¹, in contrast, resulted in strong affirmation for a well-supported zoning change. Although the realty company had shown that the regulation had reduced the value of its land from \$431,000 to \$53,000, Dedham had formally included the riparian property in a zoning revision from residential to floodplain district. While the revision effectively prohibited construction of any permanent structures, the court found that no taking had occurred. The decision was partially based on a United States Supreme Court case² which had held that a particular regulation which diminished the value of property by over 90 percent was not a taking.

Although the disparity of ruling in these cases can partially be accounted for by differences among courts and time periods, other factors support the distinction between outcomes. The community of Dedham in Turnpike Realty fully stated the purpose for its action within the regulation itself:

The purpose of the Flood Plain District is to preserve and maintain the ground water table; to protect the public health and safety, persons and property against the hazards of flood water inundation; for the protection of the community against the costs which may be incurred when unsuitable development occurs in swamps, marshes, along water courses, or in areas

¹Turnpike Realty v. Town of Dedham, 384 N.E. 2d 809 (Mass. 1972)

²Hadacheck v. Sebastian, 239 U.S. 394 (1915)

subject to flood; and to conserve natural conditions, wildlife, and open spaces for the education, recreation, and general welfare of the public.¹

The fact that the court was clearly able to understand the community's action, and the evidence of flood danger presented, enabled the court to assess likelihood of harm and community interest in balancing values.

Issues Regarding Compensation

Although a number of articles providing clarification have appeared in the Rhode Island press, many local and state officials in the Bay watershed appear to remain uncertain as to whether and to what extent local and state actions will be affected by the U.S. Supreme Court decision in First English Evangelical Lutheran Church of Glendale v. County of Los Angeles², known as "First English." Although initial media coverage represented the decision as a victory for land developers and regulated industries at the expense of local and state governments, legal analysts in Rhode Island have postulated that the case will actually work to the advantage of regulatory bodies in the state (McKinley, 1987).

The First English case clarified the remedies available to governments whose regulatory actions are found to effect takings. Formerly, under California law, governments were permitted simply to repeal or amend the contested regulation, or to limit the specific application. By contrast, in Rhode Island, the case Annicelli v. South Kingstown³ had given the town no such option when a taking was established, requiring the town to pay the full value of compensation, equal to fee title acquisition. If the decision in First English had been available at the time of the Annicelli decision, Supreme Court affirmation for broader town options would have been at hand, although much case law supportive of alternative remedies was relevant at the time.⁴

The U.S. Supreme Court, in First English, explicitly cited several of its most longstanding decisions on the takings issue, affirming that the burden of proof imposed on those alleging a taking will continue to be heavy, and that the resolution of particular claims will be largely dependent on the unique facts of the case at hand.

The property owner or regulated entity may still be required to prove that it has been deprived of all practical or reasonable beneficial use or that the government's action does not substantially advance legitimate public interests. A diminution of value, even if it amounts to a significant portion of the total, will remain insufficient in and of itself to establish that a taking has occurred. If portions remain available for use, even if profit may not be maximized, no taking will have occurred. Again, the Court reaffirmed the principle that an investor, on purchasing property, has no right to disregard the possibility that regulations to be enacted in the future, in response to changed circumstances, will qualify

¹Turnpike Realty v. Town of Dedham, 384 N.E. 2d 809 (Mass. 1972)

²First English Evangelical Lutheran Church of Glendale v. Cnty of L. A., 107S.Ct.2378, 1987

³Annicelli v. South Kingstown, RI, 463 A2d 13 (1983)

⁴State v. Johnson, 265 A.2d 711, (Me. 1970); Bartlett v. Zoning Commission of the Town of Old Lyme, 161 Conn. 24, 282 A.2d. 907 (1971); Dooley v. Town Planning and Zoning Commission of the Town of Fairfield, 151 Conn. 304, 197 A.2d 770 (1964); Morris County Land Improvement Co. v. Township of Parsippany-Troy Hills, 40 N.J. 539, 193 A.2d 232 (1963)

his/her use of the property at hand. In other words, a purchaser does not buy a "right" to an existing regulatory scheme.

Legitimate use of police power, too, was supported in First English, as it had been earlier in 1987 by the Keystone Bituminous Coal case. No property owner has the right to "spillover" onto another's property or to create a nuisance. As litigation in First English proceeds, Los Angeles county will likely succeed in proving that it acted reasonably to protect the public health when it prohibited construction of a camp for handicapped children in a floodplain. (Although press reports implied otherwise, the actual taking issue itself has not yet been litigated because of the procedural stance resulting from the state court's dismissal of the Church's claim.)

Press reports further created the impression that any delay by government in responding to property owners' proposals or developers' requests for approval would be compensable. In fact, the Court attempted to counter that impression, stating that "normal delays in obtaining building permits, changes in zoning ordinances, variances, and the like" were not being considered by the court, and that "depreciation in value of the property by reason of preliminary activity is not chargeable to the government" and does not "work a taking." Quoting its 1980 Agins¹ decision, the Court reaffirmed that "mere fluctuations in value during the process of government decision-making, absent extraordinary delay, are 'incidents of ownership.'"

3. Equal Protection

"...nor [shall any state] deny to any person within its jurisdiction the equal protection of the laws..."

In the context of non-point source control, equal protection requires that a government have a valid reason for treating similarly characterized lands differently. Parcels of land having similar soils properties, slope, hydrogeological character, proximity to resource areas, and percent impermeable cover, for example, can be regulated differently only if a recreational justification exists. If the parcels are subject to different levels of contamination or adjacent land uses justify a different non-point source management approach on one than on another, for example, a government may regulate the two parcels differently. If the two owners' parcels involve substantially the same degree of toxic or nutrient loading potential, however, the restrictions imposed should be much the same.

Communities may apply different tax assessments to erosion-prone properties and those having stable, or stabilized soils. Taxation of erosion-prone lands based on intensity of use might encourage passive use or effective soil conservation practice. Because equal protection does not require rigid equality of treatment, such a classification could be justified on the grounds that certain uses of erosion-prone soils require greater expenditure of community revenues. (Valuable watershed flood-storage capacity is lost due to sediment accumulation; public works dollars must be spent in maintaining drains, check-dams, and catch basins, etc.)

A community's decision to limit its expenditures in certain areas, for example, by limiting availability of sewer service to particular households in a geographical area, may

¹Agins v. City of Tiburon, 447 U.S.255.

also open it to challenges on equal protection grounds. Like taxation, however, non-expenditure can generally be based upon any rational or material difference which serves to distinguish the non-recipients of community funds from the recipients (Godschalk, et al., *ibid.*). Reliable data is needed to refute such challenges, but data collected to support development of overall sewage management plans or erosion control policies should be available. A well-conceived plan should demonstrate that the use of classifications and different treatment procedures was widespread and rationally justified, and not disproportionately placed on a few properties.

Moratoria and Interim Ordinances

Responding to the need to control potentially harmful development impacts while necessary research and planning proceeds, many communities have adopted interim ordinances or moratoria. These instruments constitute a temporary deferment or delay in the issuance of government permits, and must be both reasonable in purpose and limited in duration. In addition, where the potential for imminent environmental damage can be demonstrated, moratoria can be enacted to prevent such damages.

Use of moratoria and interim ordinances has recently been viewed with some trepidation in Rhode Island, due to the outcome of specific legal challenges. In Q.C. Construction Co. Inc. v. Gallo et al.,¹ for example, plaintiffs challenged the constitutionality of a residential building moratorium enacted by Resolution of the Town Council in 1983. The Rhode Island District Court ruled for the developer, citing flaws in the manner in which the moratorium had been conceived and implemented.

The Opinion handed down in Q.C. Construction, however, reaffirmed longstanding judicial approval for the legitimate use of moratoria in addressing community needs. When moratoria form part of a comprehensive plan to remedy a given problem situation, they have consistently been approved.² Even where a history of harmful outcomes has not yet developed, moratoria may be used to study potential needs and to develop a coherent approach to prevention of public harm. As confirmed in First English, moratoria may be considered as a universal planning tool. However, those moratoria not adopted in furtherance of a coherent course of study or in an effort to develop a comprehensive plan have been treated with less deference.³

With regard to duration of such measures, courts have supported moratoria enacted as regulatory instruments of temporary, reasonable, or limited duration,⁴ and have insisted

¹Q. C. Construction Company, Inc., et al. v. Gallo et al., C.A. NO. 85-224 I

²Schafer v. New Orleans, 743 F.2d 1086 (5th Cir. 1984); Smoke Rise, 400 F.Supp. at 1385; Golden v. Planning Board of the Town of Ramapo, 30 N.Y.2d 359, 285 N.E.2d 291, 334 N.Y.S.2d 138 (1972) appeal dismissed; Rockland County Builders Assoc. v. Mcalevey, 409 U.S. 1003 (1972)

³Westview Forest Estates, Inc. v. Village of So. Nyack, N.Y.2d at 428, 244 N.E.2d at 702, 277 N.Y.S. 2d at 133

⁴Schafer v. New Orleans, 743 F.2d 1090 (5th Cir. 1984); Smoke Rise, 400 F.Supp. at 1385-1386

that municipal officials act diligently and in good faith in pursuing the necessary improvements.¹

In First English, the Supreme Court acknowledged that a public safety defense to a takings claim may be available as to interim measures, as well as to regulations of a more permanent nature. The 1979 ordinance challenged by the church had been adopted in response to a severe flood, for public health and safety reasons. Although it had been amended in 1981 to permit the construction of certain types of structures, the criteria traditionally used to determine the validity of moratoria will probably be applied in the Court's examination of the issues:

"We have no occasion to decide whether the ordinance at issue actually denied appellant all use of its property or whether the county might avoid the conclusion that a compensable taking had occurred by establishing that the denial of all use was insulated as a part of the State's authority to enact safety regulations."

Generally courts have recognized that powers to protect public health, safety, and welfare, that is, police powers, must be extremely broad and responsive in order to both address changes in community needs, and react to improvements in data relied upon in assessing those needs. This necessary flexibility was emphasized in the judicial opinion rendered in Candlestick Properties²:

"In short, the police power, as such, is not confined within the narrow circumspection of precedents, resting upon past conditions which do not cover and control present conditions...that is to say, as a commonwealth develops politically, economically, and socially, the police power likewise develops, within reason, to meet the changed and changing conditions."

In O.C. Construction Co., Inc. et al. v. Gallo et al., the court found weaknesses in the manner in which the town's resolution had been applied: a) the resolution was not part of a comprehensive plan to remedy the sewer problems; b) it was not time limited in its effect; c) the town had taken insufficient steps to remedy a chronic problem.

In providing remedy to the plaintiffs, the court mandated that the Johnston building inspector should view current and future building permit applications in the neighborhood with regard to their compliance with the building code and not with regard to the moratorium, and that sewer tie-in permits should be granted. Costs and fees were also awarded. Clearly, the town's efforts to deal with a severe sewer back-up and flooding problem, though legitimate in concept, were poorly served by the inadequately supported moratorium.

Other moratoria have been implemented successfully in Rhode Island. South Kingstown instituted a building moratorium during the period in 1985 and 1986 when the

¹Wincamp Partnership, OTC v. Anne Arundel County, Maryland, 458 F. Supp. 1009, 1030 (D. Md. 1978); Charles v. Diamond, 41 N.Y. 2d at 327, 360 N.E.2d at 1301, 392 N.Y.S.2d at 600; Belle Harbor Realty Corp. v. Kerr, 35 N.Y.2d 507, 512, 323 N.E.2d 697, 699, 364 N.Y.S.2d 160, 163 (1974)

²Candlestick Properties, Inc. v. San Francisco Bay Conservation and Development Commission, 89 Cal. Rptr. 897, 905 (1970) (citations omitted)

town comprehensive plan was undergoing revision, which was unchallenged. Similarly, the sewer tie-in moratorium enforced jointly by South Kingstown and Narragansett, and a building moratorium put in place by Narragansett during its comprehensive plan updating process have met with success. The effect of an aquifer protection-related construction moratorium now in force in Burrillville is less clear. Although proposed construction in aquifer protection zones must meet certain standards applied by the town planning board, a chemical plant has been permitted to locate in the recharge area.

The Need for Clarity of Definition

Turnpike Realty raised issues which have been central to the outcome of a recent Rhode Island case, Gara Realty, Inc. v. The Zoning Board of Review of South Kingstown, et al.

¹ In the Gara Realty case, in which a landowner sought relief from town zoning restrictions governing the setback of an ISDS from a waterway, the Rhode Island Supreme Court reviewed several issues: whether less restrictive state (DEM) requirements superceded the town ordinance; whether the review board had applied an erroneous standard for review; whether the decision of the review board was substantially outweighed by the evidence; and whether the review board had violated the petitioner's rights under the U.S. and Rhode Island Constitutions.

While affirming the Town's authority to exceed DEM's minimum ISDS standards, the Supreme Court reversed the Superior Court, ruling that the petitioner should be granted relief. The decision was based on the contention that the landowner had met the burden of proof necessary to justify the type of relief which should actually have applied, given the nature of the zoning ordinance itself. Specifically, the court ruled that Gara Realty must be granted an exemption from the 150-foot setback requirement since it was eligible for a "deviation" of the zoning setback requirement.

Two key concepts are illustrated here: the importance of definition of "permitted use" and the need for governments to clarify relief available. With regard to the definition of permitted use, the town had established single-family dwellings as permitted by zoning, leaving open the presumption that ISDS would be an accompanying permitted use on property zoned residential. Thus the petitioner did not need to seek a variance for "a purpose not ordinarily permitted," requiring proof of deprivation of all beneficial use of property, but was instead eligible for a "deviation," defined as the type of relief available from restrictions governing a permitted use, such as area or setback restrictions.

If the town had established the construction of an ISDS within a 150 foot setback from a waterbody as a prohibited use that would only be allowed as a special exception, the ruling might well have been different. The town of Narragansett, for example, has recently established zoning overlay districts which prohibit use of ISDS under given conditions.

¹Gara Realty v. Zoning Board of Review of South Kingstown.

Clarification Provided by an Amendment to the R.I. Constitution

In response to general concern regarding the effect of the Annicelli decision on local and state regulatory action, delegates to the 1986 Rhode Island Constitutional Convention prepared findings and recommendations supporting amendment of the Rhode Island Constitution to clarify the state's position. The resulting resolution contained amendments to Article I, Section 16 of the state Constitution, which were overwhelmingly approved in a subsequent referendum. Section 16 of Article 1 now reads:

Section 16. Private property shall not be taken for public uses, without just compensation. The powers of the state and of its municipalities to regulate and control the use of land and waters in furtherance of the preservation, regeneration, and restoration of the natural environment, and in furtherance of the protection of the rights of the people to enjoy and freely exercise the rights of fishery and the privileges of the shore, as those rights and duties are set forth in section 17, shall be an exercise of the police powers of the state, shall be liberally construed, and shall not be deemed to be a public use of private property.

The amendment clearly affirms the will of the people of the state, apart from legal precedent established by case law. Because the findings and recommendations formally address many of the issues of concern outlined in this section, they are reproduced here in full.

Findings Regarding Proposed Amendment to Article I, Section 16 of the Rhode Island Constitution

1. The pressures of increasing population, population shifts, and increasing affluence have created substantial pressure to develop all areas of this state.
2. The development which has occurred, and can be expected in the future to occur, presents the potential to cause irreparable harm to the State by adversely affecting and destroying sensitive environmental systems and natural areas.
3. Advances in scientific knowledge have established that natural environmental systems are critical to the long-term well being of the inhabitants of this state. Preservation and protection of natural environmental systems are important not only aesthetically, but also from the standpoint of public health and safety.
4. Destruction of coastal and freshwater wetlands, and of barrier beaches and dune systems, for example, created a harm to all of the public, because of the protective role those systems play in the overall ecological balance. Wetlands store rainwater runoff, regulate flooding, and serve as breeding grounds for wildlife, all of which are important ultimately to the health and economy of the state. Beach and dune systems protect against storm damage and erosion.
5. Regulation of land use is necessary to prevent harm to the public from improper practices. Solid waste disposal, for example, unless carefully regulated, can create irreparable harm to surface and ground waters.
6. Proper regulation of activities which can affect the natural environment of this State is necessary to protect the public from the harm which will flow from unwise and inappropriate activities on, and development of, land.

7. In exercising their regulatory powers over land development and use, the agencies of the State and the municipalities must be allowed to strike the proper balance of competing interests, giving full regard to the rights of the public to be protected from the harm of destruction and impairment of natural environmental systems.
8. In the past, court decisions have at times had the effect of creating an imbalance, by deemphasizing the public's right to protection against land development which creates long-term harm to the public-at-large. The decision in Annicelli v. Town of South Kingstown, RI 463 A2d. 13 (1983)¹ did not take sufficient cognizance of the harm which flows from development of barrier beaches.
9. Recreational utilization of land is a valuable, beneficial use of the property. The value of property is not necessarily destroyed by the inability to build a permanent dwelling upon it.
10. No land owner has a vested right to develop his property to achieve the maximum, or any profit from it, or to be free of environmental regulation enacted after he or she acquires it.
11. It is necessary for the health and welfare of the people of the State of Rhode Island that the agencies and municipalities of the State be granted the fullest latitude, constrained only by the Constitution of the United States, in balancing the needs of the public for protection and preservation of the natural environment of the state against the wishes of land owners to develop land in a way that will be destructive of the natural environment.

Recommendations Concerning Article I Section 16 of the Rhode Island Constitution

1. Despite court decisions apparently distinguishing the prevention of "public harm" from promotion of the "public good," the attempt provides little or no guidance to government. Such distinctions have had the effect of chilling government's ability to anticipate and prevent harm to the environment and natural resources of the State which are held in trust for the people of Rhode Island. To the extent that the Rhode Island Supreme Court decision in Annicelli v. Town of South Kingstown relied on the Rhode Island Constitution, this Constitutional Amendment seeks to overturn that decision.
2. Those state and local government decision-makers whose responsibilities are to protect the environment and human health should be encouraged to exercise those responsibilities so as to prevent potential harm, rather than having to wait for those harms to occur. For example, the landfilling of solid waste, recently thought to be solely an aesthetic or nuisance issue, is now generally perceived to be a practice posing substantial risks to underground drinking water aquifers. It is essential that government act to anticipate potential harms to the environment without being required to pay compensation to landowners whose use of their land may be affected.
3. If a local or state government is found by a judicial tribunal to have exceeded its legitimate police powers that entity should be permitted to elect whether to pay compensation to the affected landowner, or alternatively to amend, repeal, or not enforce the regulation, decision, or act at issue.

4. Where the state or local government has acted in the police power to protect the public health, safety or welfare and where a close question is presented, the courts should give the benefit of the doubt to the state or local decision.
5. In all instances where an act or regulation of state or local government is challenged as excessive, the courts should presume the validity of such act or regulation, which presumption may only be overcome by a party challenging it by clear and convincing evidence.
6. Where a local or state government has determined that an act or regulation is necessary to protect the public or the environment, a court should not hold to the contrary absent a showing that such determination is arbitrary and capricious.

Conclusions: Factors Strengthening Government Powers

Numerous methods exist enabling governments to avoid limitations, or increase available powers. These concepts cannot ensure judicial acceptance in all cases, because powers differ among governments, as do courts' interpretations of them. Although limitations must be seriously considered, the following methods have been found to strengthen legitimate exercise of authority:

1. Government actions are strengthened if components of a local, regional, state, or federal program. A plan provides a broadened base for the government action, demonstrates reasonableness, and negates claims of arbitrariness or unfairness. Increased weight may be attached to the individual government action. In the Del Norte case¹, for example, the county enacted its regulations in compliance with an Army Corps of Engineers plan. In reviewing the action, the court therefore attached additional significance to the program and accorded a strong presumption of validity to the action.

Similarly, In Candlestick Properties,² the denial of a permit to fill a parcel of land submerged by high-tide waters of San Francisco Bay was based in large part on compliance with the regional plan to preserve the Bay and prevent haphazard fill activities. The Court upheld the regional approach. State policy represented by a state legislative program gives strength to the police powers of a region or locality.

2. To strengthen police power authority, regulations should emphasize the protection of human health, safety, and welfare, especially the first two of these where applicable. Linkages between protection of natural resource values and protection of human welfare should be strongly established in statements of purpose. (New Jersey, for example, has emphasized human welfare protection in implementation of its strict coastal land use restrictions.)

Courts have, however, supported land use regulations that address protection of environmentally significant values. Protection of wetlands, water quality, and floodplain

¹Turner v. County of Del Norte, 101 Cal. Rptr. 93 (1972)

²Candlestick Properties, Inc. v. San Francisco Bay Conservation and Development Commission, 89 Cal. Rptr. 897, 905 (1970) (citations omitted)

areas have been recognized as valid police power objectives. A Maryland case upholding exercise of police power in wetlands protection, for example, resulted in a ruling which emphasized ecological values:

"A valid exercise of the police powers...for the state to preserve its exhaustible natural resources. The current trend is to consider the preservation of natural resources as a valid exercise of the police powers."¹

3. Clear and detailed statements of purpose and findings of fact will strengthen the presumption in favor of the community action and enable a court to better understand and uphold it. Convincing evidence of the range of public hazards created by damage to or destruction of aquifer recharge areas, wetlands, floodplains, etc. should be inserted in "whereas" clauses and policy statements, along with inventories and clear classifications of the areas at issue. Particularly when balancing or more subjective judicial tests are used in evaluating a challenge to a government action, courts accord weight to clear statements of purpose and detailed findings of fact (Conservation Foundation/FEMA, 1980).
4. Mapping procedures should provide opportunity for landowners to prove a regulatory map's inaccuracy, given cause.
5. Careful and thorough drafting to permit cluster development in suitable areas or to target development toward areas consistent with the purposes of resource protection will lessen the likelihood of successful challenge. All profitable uses of property that will not create or aggravate damages to natural resources should be allowed. Creative economic uses compatible with resource protection should be encouraged. That is, the range of permitted activities should be maximized in order to minimize the taking issue. All potentially impacting activities, however, should be subject to permit review. No major uses should be exempted per se.
6. If variance procedures are to be provided as a hedge against the taking issue, clear and firm criteria for all types of variances, special exceptions, and variations should be set. Hearings should be held and written findings presented to describe to the public how variance criteria would be met. Variance-granting procedures should be as publicly visible as possible, in order to ensure complete accountability.
7. Similarly, permit reviews should be conducted with careful attention to procedural "due process." Notification of requirements, deadlines, etc. should be ensured for the applicant and the public, and procedural steps should be published as public notices to avoid implication that any result has been predetermined.
8. The manner in which regulatory strictures are linked is frequently very important in successful implementation. Specific construction standards and performance standards should be provided, to ensure clarity regarding what procedures an applicant must undertake and how they are supposed to work. Performance standards (e.g. prevent siltation) without construction stipulations are excessively vague, while construction standards alone allow an applicant to ignore the failure of a particular pollution control measure.

¹Potomac Sand and Gravel Co. v. Governor of Maryland, 293 A.2d 241, 248,249 (1972)

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